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ABSTRACT

This is the third in a series of publications utilizing papers presented at the annual conference of the National Association for Environmental Education. The 29 selected papers are divided into the following categories: Energy, International Environment, Population/Population Education, Natural Environment, Values, Learning, and Curriculum and Program. These papers provide information and available knowledge on a wide spectrum of topics in environmental education. A listing of references is included with each paper. (MA)

CURRENT ISSUES

IN

ENVIRONMENTAL EDUCATION - III

Selected Papers from the Sixth Annual Conference of the National Association for Environmental Education

Robert H. McCabe, Editor

ERIC/SMEAC CENTER FOR SCIENCE, MATHEMATICS, AND ENVIRONMENTAL EDUCATION.

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CURRENT ISSUES IN ENVIRONMENTAL EDUCATION - III

Selected Papers from the Sixth Annual Conference of the National Association for Environmental Education

Edited by
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ENVIRONMENTAL EDUCATION INFORMATION REPORTS

Environmental Education Information Reports are issued to analyze and summarize information related to the teaching and learning of environmental education. It is hoped that these reviews will provide information for personnel involved in development, ideas for teachers, and indications of trends in environmental education.

Your comments and suggestions for this series are invited.

John F. Disinger
Associate Director
Environmental Education

Sponsored by the Educational Resources Information Center of the National Institute of Education and The Ohio State University.

This publication was prepared pursuant to a contract with the National Institute of Education, with the cooperation of the National Association for Environmental Education. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their judgment in professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official National Institute of Education position or policy.

FOREWORD

The 1977 Conference of the National Association for Environmental Education, April 24-26, attracted to Estes Park, Colorado more than three hundred persons with a broad range of interests in environmental education. The papers that were presented covered the widest spectrum that has as yet been presented at an NAEE conference. The papers selected for inclusion in Current Issues in Environmental Education - III were organized into clusters representative of the conference. The largest clusters concern values, curriculum and teaching/learning. Each of these groupings is comprised of a fine collection of materials. In addition, there are excellent papers on energy, international education, population - population education and the natural environment.

This is the third in a series of annual publications utilizing papers presented at the NAEE Annual Conference. This annual publication is an ongoing series designed to add to the information and knowledge available concerning environmental education. Though all of the papers submitted could not be included in the publication, all contributions were appreciated and most will be made available through ERIC.

The editor takes this opportunity to recognize the indispensible work of those who served as associate editors and to the contributors for their professional efforts.

The Association wishes to express its sincere appreciation to the ERIC Center for Science, Mathematics, and Environmental Education for sponsoring the publication and to John Disinger for his cooperation and patience.

Robert H. McCabe
Editor

September 1977

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ENERGY CONSERVATION: BY CHOICE OR BY FORCE

Kevin C. Gottlieb
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Since 1947, U.S. energy consumption has more than doubled - from 33 to 75 quadrillion B.T.U. annually. According to Department of Interior projections, U.S. energy consumption in the year 2000 will require 192 quadrillion B.T.U., about two and one half times our 1974 level of 75 quadrillion. In order to meet the projection for the year 2000, the U.S. would have to import 61 quadrillion B.T.U. of oil and gas, which is equal to our entire national energy consumption for the year 1968. Where will this energy come from?

In 1974, the average American used twice as much energy as the average Englishman, two and one half times as much as the average German, and four and one half times as much as the average Japanese. Today, three years after the Arab oil embargo, our performance in this comparison is worse, not better. Why is this the case?

Within the past two weeks, governmental studies revealed a serious error in computing the amount of known world oil and natural gas reserves. Therefore, imported energy, our current source for sustaining rampaging energy needs, may not be available for as long a period as previously believed.

Moreover, since it takes from three to ten years to bring on line a new oil field, and two to five years for new coal mines, and ten years for nuclear plants, one might ask justifiably, "What will this nation do?" President Carter has outlined one plan for proceeding, which I will examine at the end of this paper. He is correct in stressing the importance of energy conservation, but does his new energy conservation policy go far enough? Will it make people conserve? I submit that the absence of adequate mandatory, coercive measures dooms his policy to fall short of the savings needed for this society.

If the U.S. saved ten percent on total energy consumption, it would be the equivalent of developing 200,000 new oil wells, or developing 2930 new coal mines, or building 211 additional nuclear plants. Seen in the light of these figures, there is powerful logic for choosing the course of energy conservation. Why is this nation turning to energy conservation only now, and why is the government proposing so little so late?

This paper examines the energy conservation problem from the perspective of public policy analysis, specifically policy development and implementation. The author will contend that of three possible economic systems: capitalist, socialist, and non-hierarchical, the U.S. operates a predominantly capitalist system which is structurally incapable of responding adequately to a problem of the current magnitude of U.S. energy conservation. After explaining some of the inadequacies of the present system, examples will be given of one other system, operating in Sweden, which has functioned more effectively to conserve energy: Of the nations in the International Energy Agency (IEA), Sweden finished first while the U.S. placed last, in energy savings per capita. Someone should ask why this is so? This paper will offer some tentative answers.

Following the comments on Sweden, there will be an explanation of the new Carter energy policy and some suggestions for modifying that policy, in substance and procedure, in order to achieve the necessary energy savings.

To analyze the current status of energy conservation policy, one might examine four dimensions: the genesis of the policy; the development of the policy, the implementation of the policy; and, finally, the feedback on the policy.

It is doubtful that the U.S. would have embarked on an energy conservation policy simply because the finite nature of present energy sources became known. Indeed, the finite dimension which has prompted our nation to act now is only a secondary consideration for most people. The primary consideration, at most levels, is that we have finally realized that even if we wanted to allow our rate of energy use to continue to grow at 4.6% per year until the sources were totally exhausted, we could not place those increased supplies on line fast enough to meet the growing demand. Therefore, in order to avoid immediate dislocation in the economic, political, social, and psychological sectors, it has become necessary for the policy planners in this society to become more assertive and more directive than is conventionally acceptable. To be sure, these policy-makers also understand the finite nature of energy resources. That alone, however, would not have been adequate to constitute the genesis for a policy change which requires so many elements of control. The knowledge, for example, that there may be only three decades of liquid fossil fuel supply remaining would not sufficiently congeal public political support to the point where the public, through the Congress, would accept controls on their lives. The sad truth is that the majority of the voting public would interpret the estimated three decades as a cushion of time against which the nation could bounce until the next technological trick saves us again.

While it is true that environmental groups and resource specialists have lobbied for energy conservation, their political influence has been limited by the size of their numbers. Far more influential have been those interests which argue that more energy means more jobs which translates as a healthier economy. Clearly, this "more energy" philosophy is a spurious one if it is supposed to be a guarantee of more jobs. Economists for the Chase Manhattan Bank estimate that at the present energy growth rate, the energy industry must borrow more than one trillion dollars in the next ten years to finance oil exploration, power plant construction, and other major capital energy investments. If they were to follow this course, there would not be enough capital left over to build the factories, autos, and other items to use that energy. Moreover, the construction of power plants creates fewer jobs per dollar than almost any other form of capital investment. Indeed, on the jobs issue, if zero energy growth were properly managed, the economy and the number of jobs could continue to grow, albeit modestly. A recent study, distributed by U.S. Representative Morris Udall's committee in the House, demonstrates that environmental protection has created more than a million jobs even though less than ten percent of the pollution control requirements so far have been satisfied. More jobs are possible in water treatment plants, solid waste recovery, waste heat recovery, general resource recovery, and mass transportation. Obviously in waste heat recovery and solid waste recovery, there is potential for enormous energy savings which could more than compensate for energy needs in these job areas.

The point which must be stressed on the genesis of the new energy conservation policy is that the public as a majority has not fundamentally changed its level of awareness or increased its understanding. This sad conclusion augurs badly

our future. Two revelations in the past month prompt my assessment. First, the President's energy policy team headed by James Schlesinger reveals that they spent $350,000 to solicit energy conservation suggestions from the public. After spending $17.50 for each response, they now know that "few people seem to expect to suffer deep or lasting hardships." Second, a recent nation-wide Gallop poll found that a sizable majority of the public still does not believe that energy is a serious problem.

In a democratic society, with a system of free enterprises, how vigorous will the legislative policy planners be in controlling public consumption when they realize that their constituents continue to underestimate the need for control? This disparity between the needs of the society and the knowledge of the public confuses the policy development stage.

Contemporary discussion of a national energy policy began during the administration of President Gerald Ford. However, the fundamental ideological split, between a Republican executive committed to voluntary controls in the private sector and a Democratic Congress more interested in mandatory controls from the public sector, doomed the 1975 national energy policy to defeat. The 1975 bill, which passed the House Ways and Means Committee, had the following provisions: gasoline taxes (5¢ per year over five years); a tax on big cars which guzzle gas; new taxes on some industrial uses of petroleum and natural gas; tax cuts for Americans who install insulation in their homes; oil import quotas; and new duties to replace existing petroleum tariffs. Do these sound familiar? They should! They have just been proposed again by the Carter Administration. Preliminary government revenue estimates on the 1975 House energy bill (sponsored by Representative Al Ullman) were for a gross of $75.5 billion through 1980, with the deduction of special refunds and exemptions leaving a net of $19.6 billion. According to the bill, the money was to be used as an energy trust fund for finding new sources of oil and developing new methods of conservation.

For political and economic reasons, the Ullman Bill never became law. This society lost at least two precious years of scarce energy and much needed revenue. Why is this society paralyzed when action is so urgently needed? The sides are already being drawn on the Carter policy for what has been described as the century's most vehement battle between a President and Congress.

The Carter energy policy has been designed by an economist, James Schlesinger, and approximately fifteen other policy-makers, all hand-picked by Schlesinger. Most of these people have worked with him before. Few have any energy experience, and all but one are under the age of forty. The policy was constructed in about ninety days of frenetic activity. While there have been substantial outside consultation and effort, the size of the staff, the time available, and the magnitude of the problem, force this policy to be a first draft which will be modified by the Congress. In the Senate, where much of the legislative action will occur, the Carter policy proposal will be evaluated primarily by the Committee on Energy and Natural Resources, chaired by Senator Henry Jackson, D-Washington. In the House, the chief deliberative body will be the Select Committee on Energy, chaired by Representative Thomas Ashley, D-Ohio.

The Carter policy is a "use less-pay more" policy with impact on lifestyles, values, economics, and politics. But the weight of the impact is significant only when compared to past governmental policies. The new energy conservation policy is not Draconian in any sense of that term. A good example of the

policy's modest nature is the provision for taxing gasoline. The proposed fifty cent tax rise is scheduled to be applied at the rate of five cents per year beginning in 1979. The proposal has met with vigorous opposition including that of Senate Committee Chairman Henry Jackson who suggested simply but firmly that the tax on gasoline will not go through. When one considers than an immediate increase in the price of gasoline to $1.00 per gallon would mean an expenditure of only $6.00 more per week to the average consumer, one begins to understand how very modest the Carter policy actually is.

The inevitable question is, of course, whether this nation can afford a policy of such a modest nature, modest primarily for political reasons.

Implementation of the new policy will become the responsibility of the new Department of Energy, proposed by President Carter in January of this year. This new agency will comprise the many disparate departments which have heretofore dealt with energy matters. Included in this amalgamation are the two most pr[illegible] agencies, the Federal Energy Agency (FEA) and the Energy Research and [illegible]nt Agency (ERDA).

It is a truism that the effectiveness of a policy is only as strong as the policy's implementation. If an agency fails to pursue implementation vigorously, it matters little whether the policy is strong or weak. Unfortunately, this failure to implement has plagued previous energy policies. An example is the policy of forcing utilities and large industries to switch from using oil and gas to coal. It has been FEA policy since mid-1974 to require this switch. Indeed, the FEA promised the Congress that FEA would order at least 32 utility power plants to convert to coal by the end of March, 1977. Even though many of these utilities had coal burning equipment already in place, the March deadline passed and not one single order has been issued. Moreover, FEA issued a similar commitment to force conversion with 39 other sites and not one notice of intent has been sent on those sites either. With this record of implementation, one has to wonder if the public can justifiably expect the bureaucracy's response on the Carter policy to be any better. To understand how crucial the previous sentence is, one must realize that the Carter coal conversion plan is designed to save the nation about four million barrels of oil a day by 1985--anticipated savings greater than any other proposal in the Carter energy package. One can easily imagine the negative impact which failure to implement would represent.

Another problem area for implementation concerns energy supply and current use patterns. How long can the energy agencies continue to maintain that the major emphasis in future energy supply must be consistent with current use patterns? When will the agencies provide legislative interpretations which alter use patterns by altering the administration of the energy policy? Revised energy use patterns constitute a crucial benchmark for our future. Our nation must be concerned about secondary use patterns as well as the more primary uses for production, home heat, and transportation. For example, how can one alter the public's attitude toward the use of various products? Victor Papanek, in his book, Design For the Real World, accentuates the need for an attitudinal change when he discusses the use of products in three categories: bicycles, automobiles, and general purpose industrial equipment. Each of these products have a "primary useful product life" (measured in years) which is substantially larger than the "actual time (the product is) used in the U.S." Moreover, the years the product is used in the U.S. is also a far smaller number than the actual time the item is used in developing countries (see table on the following page).

Product	Primary Useful Product Life in Years	Actual Time Used in the U.S. in Years	Actual Time Used in Underdeveloped Countries
Bicycle	25	2	75
Automobiles	11	2.2	40+
General Purpose Industrial Equipment	20	12	75+

If a nation can learn to maintain these and other products adequately and realign the number of years an item is used in the U.S. with the item's "primary useful product life," then the energy savings would be immense. First, the proliferation of repetitive industrial products would be reduced, i.e. buying a second lawn mower because you were careless with your first. Second, the saved energy could be used to perform other tasks which might have required new or additional energy outlays.

By implementing legislation with rigorous policy recommendations, agencies could encourage energy use which is more efficient because following the converse would be too costly in real dollars.

The feedback on the Carter policy has already begun. Indeed, the feedback began before the policy was announced. Citizens have reacted strongly to the gasoline tax, so strongly in fact that the President backed away completely from a gas tax when responding to the question at his citizen phone-in program. The idea of the gas tax which had been adroitly leaked, publicly, during the previous week produced such negative reaction that the President was forced to deny that he had ever suggested a tax.

Congressional feedback, more tentative in the days before the energy policy announcement, has now emerged as outright praise or condemnation. For the most part, the reactions are as expected. Those Congressmen from producer-states view some aspects of the policy as "too little, too late" and others as "too much, too early." Members of Congress from consumer-states; while supportive of the provisions for improved technology, are uneasy when they consider the increases in prices permitted by the policy. Industry, as expected, opposes the taxes, the restrictions, the ceiling on the price rises, and the new regulations on efficiency. Labor is concerned about the potential loss of jobs from reduced energy growth; management views the reduction as the end to economic expansion. And since January, the stock market has been unsure how to react. The feedback from Wall Street might be best described in that World War I expression, "watchful waiting."

Clearly, the importance of the feedback mechanism is its ability to serve as the genesis for a second round of policy development. This development might assume the form of calls for an entirely new policy or for modifications in the old one. The modifications might occur through amendments to new, unrelated, legislation or by revised directives to agencies administering the existing policy. Using the Carter energy policy as an example, it is, of course, too early to plot accurately what course the feedback will follow.

A country's economic system has much to do with its policy-making processes. Consequently the energy conservation policy which a nation issues will, inevitably, be conditioned by the system's economic foundation and the capacity to respond.

"A capitalist economy may be defined as a system in which most of the productive apparatus of society is owned by private, profit-seeking businesses. The production of different products, the division of labor, and the allocation of other resources are directed to some extent by the invisible hand of the market. In addition, the majority of the population earns its living from work for wages or salaries in businesses they do not themselves own."[1] In a capitalist system pressure is exerted on the employer (capitalist) as well as the employee (worker) to expand or grow. Businesses grow and invest in new and advanced equipment because they fear outdated technology will mean lost markets to competitors; this leads to bankruptcy and the return of the capitalists to the working class. The fear of this failure is sufficient to ensure that profits will be maximized and that a substantial amount will be reinvested. Employees hope their additional efforts on the job will bring promotion. Each promotion thereafter may rely on factors such as the number of employees under one's supervision or the amount of business transacted by one's division. Reinvestment for growth is the obvious compromise between capitalists who want to keep managers' salaries down and managers who do not want large dividends distributed to owners. These institutionalized incentives for growth reinforce this idea and in fact make companies search for ways to promote the most growth in the short run, not the best growth for society.

Governments also pursue policies to stimulate growth so their companies can compete in the international market plan. This often leads countries to seek spheres of influence in certain parts of the world where their rivals can be easily excluded.

Socialism, when contrasted with capitalism, is theoretically quite different. However, socialism is similarly susceptible to problems: forcing growth, spawning a new class of bureaucrats and planners, setting goals erroneously, and encouraging artificial infallibility on the part of the government.

In theory though, a well-functioning socialist system attempts to perform most of the following functions: instruct enterprises to seek quality products, first, and reasonable profits, second; set realistic output quotas (e.g. ones that allow for the reduction of environmental costs); provide for active intense monitoring of governmental personnel and policies; designate industrial compliance with environmental standards as a means to managerial promotion and reward; guarantee employment; establish non-profit oriented incentives (e.g. for conservation) and encourage democratic planning-participation by the citizenry (i.e. consultation, not control).

The brand of socialistic planning indicated above could operate effectively when combined with democratic leadership. The importance of this kind of combination is evident in what might be termed "decentralized socialism." Under this type of system, the democratically elected leadership would stress the development of balanced, regional economies with both agricultural and industrial dimensions. To effect this move to regional economies, central government would have to provide incentives for moving population and industry into less-populated areas where the natural resources are more plentiful. Some specialization would continue to be necessary; however, the decision on where (i.e. in which region) it should occur would have to be consistent with a central, pre-arranged plan. The

[1] Matthew Edel, Economics and the Environment (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1973), p. 137.

central plan would delineate the allocation of resources and the coordination of production within each region as well. In essence, the socialistic mechanism would determine the mix of market planning and central planning, and where the various mixtures would be applied.

Capitalism and its psychology that growth is "automatically desirable" has hindered conservation of energy resources in the United States. Before the tenure of the Nixon Administration, the United States had no central agency designated specifically for energy research and development. There were many federal agencies and cabinet offices sharing research responsibilities in the area of energy. This is typical of capitalism's fragmentation and overlap. Each agency head operates to enlarge his agency in order to extend his power. Agencies do not coordinate their efforts because they are competitive with other parts of the same bureaucracy. Agency heads and cabinet officers compete for "political turf." The creation of the Energy Research and Development Administration (ERDA) and the Federal Energy Agency (FEA) represents an effort in the direction of coordination. The Carter Administration, dissatisfied with the level of coordination, has proposed a new cabinet office to perform the function.

Another factor which has contributed to the failure of energy conservation policy in the U.S. is the national "growth" orientation. Most Americans are not ready to accept the finite nature of this world and our declining right to the limited resources. It will be difficult to convince the electorate that conservation is in the nation's long run interest. "'This country did not conserve its way to greatness', declares chairman Mack Wallace of the Texas Railroad Commission which regulates oil production in Texas. 'It produced itself to greatness.'"[2] Furthermore, it is difficult to convince environmentalists and economists alike that conservation can be achieved without sending the economy into a tailspin. Why? Because capitalism has failed to produce economic growth within a framework of energy conservation. But has the nation genuinely tried energy conservation? "Fully 2/3 of the energy America now consumes does no actual work - and while 1/2 that loss is the unavoidable result of physical limits to efficiency, much of the remainder is simply waste."[3] Clearly, a new market has been created; technology must be developed to make engines, for example, account more efficiently for the fuel they consume.

The U.S. must succeed in conserving oil and natural gas. This means alternate forms of energy, such as solar power, will require massive development. Tax credits, accelerated depreciation allowances, and government grants, must be distributed to businesses which develop new methods of conservation and new sources of supply.

Finally, a capitalistic system offers few occasions for the public to communicate meaningfully with federal agencies. The system has failed to foster a cooperative spirit between groups who have a stake in the outcome of energy policy. As a society we remain a disparate group of conflicting powers. One exception is the New England Energy Policy Council which has been a pioneer (now a model institution) in the area of energy coordination. The Council forces consensus positions on issues by mediating among utilities, oil companies,

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[2]"How To Save Energy," Newsweek, April 18, 1977, p. 73.

[3]Ibid.

industries, public interest groups, and environmentalists in their organization.[4] Perhaps this democratic capitalist society requires a more systematic method for forcing this kind of consensus at the national level.

There is a democratic society which has designed such a system at the federal level. That country is Sweden. Furthermore, that system has enabled Sweden to shatter the myth that there is a direct relationship between per capita energy use and standard of living as measured by gross national product (GNP). Although the GNP per capita is higher in Sweden than in the U. S., Sweden used approximately 60% as much energy as the U. S. to generate each dollar of GNP in 1971.[5]

Sweden boasts of its forced frugality. It should be noted that "...80% of Sweden's total fossil fuel energy consumption is imported; and 75% of Sweden's electrical power production comes from water power..."[6] Consequently, electricity has been inexpensive relative to fuel, with both price and per capital consumption very similar to that in the United States. "Motor fuels, on the other hand, have been taxed heavily in Sweden and per capital consumption of these refined petroleum products has been far below U. S. consumption."[7] Another factor which explains Sweden's willingness to conserve oil for home heating is its unrelenting winter heating season which has acted in lieu of higher prices to stimulate conservation efforts.

The underlying reason for the willingness of the Swedes to conserve may be the same reason why Americans will not: the economic orientation. Socialist Sweden has used its centralized means of distributing information, regulations, and incentives, to blanket the citizenry with knowledge of current national energy problems. (This process minimizes information costs. The U. S. with its proliferation of agencies and levels of government makes confusion and delay inevitable. Consequently, public hearings usually draw only interest groups because the general citizenry has been inadequately informed). Evidence of the success of the Swedish method was demonstrated when 250,000 Swedes accepted a national invitation for instruction on the conservation of natural resources. Of this group, 10,000 people accepted two weeks additional instruction and 1,000 citizens remained for a third course.[8] These seminars not only aroused the public about the urgency of conservation but they instructed average citizens to organize and represent themselves at public meetings and appropriate government hearings.

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[4]"Removing the Rancor From Tough Disputes," Business Week, August 30, 1976, p. 92.

[5]"Efficient Energy Use and Well-Being: The Swedish Example," Science, December 3, 1976, p. 1001.

[6]"Sweden: Doubts of Nuclear Power," Environment, November, 1973, p. 43.

[7]"Efficient Energy," op cit., p. 1002.

[8]"Pollution Control: Sweden," Science, October 10, 1969, p. 2001.

Furthermore, the Swedish government has shown foresight by settling on one national agency to lead its conservation efforts. The Ministry of Agriculture received the National Nature Conservancy Office and a $50 million budget. This ministry, which had been declining in importance due to the reduction of agricultural influence and the expansion of industry, approached the project with enthusiasm because of the importance of the project and the crucial responsibilities which would be delegated to the ministry.

Another example of a disciplined Swedish response is the public reaction to the high tax on fuel. "For trips of 10 km or less, for which autmobile fuel consumption per mile is nearly double, the Swedes use private cars and public transportation in the ratio 55%-45%. In the U. S. by contrast, the rate is 90%-10%."[9] This type of transportation accounts for 65% of all automobile trips in the U. S. Of course, because of conscious choice and central planning, Swedish mass transit is more readily available than similar transportation in the U. S.

Another interesting Swedish device for conserving motor fuel is the matching of vehicles with tasks according to the demands of the task especially in short-haul situations. Small station wagons and four cylinder micro-buses or diesel mini-trucks are used extensively in Sweden. Their use is encouraged by substantial vehicle taxes.[10]

In the category of home heating, Sweden enforces strict building codes which permit only energy efficient construction. "A bill designed to promote energy-saving measures in private homes and other buildings in Sweden has been submitted to Parliament by the Minister of Housing. If approved, the bill will entail a total outlay of Kr.429 million ($100,000,000) for fiscal 1977-78, which is Kr .129 million more than in the current fiscal year.

Loans will be increased and made available for up to 65% of the total approved outlay involved in the requisite structural improvements. Amortization time will be twenty years. Outright grants will be raised by 50% to a maximum of Kr.3,000, or up to 35% of total outlay.

The Minister also proposes that much greater emphasis be given to information and training, particularly with regard to local government employees and officials and building trade operatives. Local authorities should receive special grants to help finance their counseling and information activities and a survey should be made into the energy-saving efficiency of existing buildings. Finally, support to experimental building projects should be greatly expanded and a special review board attached to the Swedish Board for Building Research."[11]

For many Americans, the adoption of Swedish central planning in the U. S. is considered inappropriate. Most Americans believe the U. S. has the world's highest standard of living and the best economy. Factually, these assumptions

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[9] "Efficient Energy," Op. cit., p. 1005.

[10] Ibid., p. 1006.

[11] "Bill Aims at Promoting Energy-Saving Measures," News From Sweden, April, 1977, p. 1.

are untrue.

The U. S. relinquished its first place ranking on per capita Gross National Product (GNP) in 1950. Since then, a number of other countries have surpassed us and we fall further behind. Sweden and Switzerland, specifically, have a per capita GNP 20% above the U. S. figure.

More disturbing than the GNP statistics are the figures explaining the inequities in the distribution of economic resources. As the economist, Lester Thurow, has explained, "The richest 10% of U. S. households receive 26.1% of our income while the poorest 10% receive only 1.7% (of our income). And most of this comes in the form of government income transfer payments.... If we look at the distribution of physical wealth, the top 20% owns 80% of all that can be privately owned in the United States and the bottom 25% own nothing (many of them, in fact, have debts that exceed their assets)."[12] With inequalities such as these, is it possible for these people to have equal access to the nation's energy supply or the means for conservation?

Furthermore, the countries which are outstripping us in per capita GNP and equitable energy distribution are also exceeding our industrial productivity. Even though Sweden's energy consumption is only 60% of that of the U. S., their level of industrial productivity exceeded ours by 11% in the period 1970-75. While the economic conservatives in America would call for more free enterprise and a cut in social expenditures, the data for Sweden suggest an opposite conclusion is warranted. Sweden, the home of the most comprehensive social-welfare system in the world, achieved its statistical advantage with controls and economic planning far in excess of the level found in the U. S.

The "...best decade (for the U.S.) in terms of growth in real per capita GNP (a 36% increase) was that of the 1940's when the economy was run as a command (socialist) wartime economy. Our second-best decade (a 30% increase) was that of the 1960's with all of its social-welfare programs.... Real per capita growth since the advent of government intervention has been more than twice as high as it was in the days when government did not intervene or have social-welfare programs."[13]

Clearly this nation can have government-directed energy conservation and economic success at the same time. We can have social expenditures and economic success. Indeed, it may be the absence of effective government planning which explains our inability to maintain the economy and save energy at the same time.

When President Carter addressed the Congress on April 20, 1977, he said, "The people acting through their government will establish the energy policies for the country." One can only hope the President wants the government to act on the mandate of economic history; to give the people and the society the careful, but forceful, direction they require. Unfortunately, in the same energy speech,

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[12] "The Myth of the American Economy," Newsweek, February 14, 1977, p. 11.

[13] Ibid.

the President proposed to implement his policies through "voluntary means, with a minimum of coercion." Later, he admitted that "voluntary responses will not be enough."[14]

When President Carter quoted William James, he likened our battle over the control of energy to James' "moral equivalent of war." If government action and implementation are postponed in order to debate, and then reject, government control, the result may very well be a war, about which nothing moral will be said.

[14]"Text of Speech by President Carter on His Energy Program," New York Times, April 12, 1977, p. 46.

ENERGY ANALYSIS
THE ULTIMATE CRITERION IN ENVIRONMENTAL DECISION-MAKING

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The title of this presentation, using such a closed concept word as ultimate, is deceptively simplistic. It implies that there is, in fact, any one criterion that leads to the solution of an environmental problem. If a problem could be solved by the application of a single criterion, then it would hardly rank as a real problem. Decisions involving interaction with the environment are not simple, however, and what I plan to discuss is my idea about the most significant consideration which must be made when assessing any project. It might well be a part of a total environmental impact study, but seems to be neglected in comparison with some of the other factors which are included in a study.

Frankly, I would rather write the title to a paper than to write the paper to which the title is applied. That would then require you to fill in the body according to your own framework of knowledge and values and the outcome would have much greater personal value to you. To a very real extent, that is what I am planning to do here. I will give you the title, define my terms, and provide a couple of examples of the application of the technique to problems. I then leave the rest up to you. While I have established my own set of conclusions about the validity of my premise, and these should be rather obvious as the theme is developed, you must establish your own conclusions.

We should begin with the definitions. Since there is not universal agreement as to the best meaning for energy analysis, I will give you my own. It is interesting to note that this very topic is being debated in the letters section of Science magazine in the issue of April 15th. A couple of years ago, before the topic had become too common in the literature, I called it Energeconomics. The term energy analysis has been adopted for the general area by international agreement within the past couple of years. At the level at which I choose to engage it, and this seems about as complicated as it can be and still be of use in general education, it is an accounting procedure for energy investments and returns in carrying out a project. To be of any particular value, such a study must include consideration of both the quantity and the quality of the energies involved. Because of the different values of exchange rate of energy and the difficulty in accounting for losses, it is a much more involved and less precise area of study than financial accounting. There is not universal agreement on some very basic components of the procedure, which also adds to the complexity. Despite all this, I still consider it to be most useful.

Perhaps one of the first attempts which man might have made to do this kind of thing came with his pondering whether he would derive enough food energy from digging roots to compensate him for the effort, or energy input. At a higher level, it might be worthy to calculate how much of a precious supply of grain one should plant, knowing that the particular grain will be lost to his immediate consumption, but might be repaid many times over in another crop.

In our present time, when all our activities are more energy intensive, and the impact upon the surroundings depends as some power function greater than

one on the amount of energy involved; it has become more critical, both in terms of the impact on the environment and the best use of the limited reserves of energy which remain which might be applied to the task. It is quite possible that we may enter into some projects in which there is a net loss rather than a net gain of energy represented as well as the possibility that we are degrading some very precious energy forms to tasks that do not merit their use. To preserve for best use - to conserve - our previous energy, we must move away from our present profligate practices of deficit energy spending. In so doing, we would also be reducing our adverse environmental impact. This would be a recognition of the truth that we are drawing heavily upon a finite reserve of high quality energy which, unlike our dollar reserve, cannot be increased, either by devaluation and "creating" more, or even by accumulating interest if left in the deposit.

This train of reasoning justifies use of such an encompassing term as ultimate. Writing for Science a couple of years back, M. Gilliland, a disciple of H. T. Odum, described energy as the ultimate limiting factor in any process because: 1) energy is the only commodity for which a substitute cannot be found; 2) energy is required to run every type of system; and 3) energy cannot be recycled. Implicit in this last qualification is the concept of energy quality, and the second law of thermodynamics. We must consider very carefully the best application of our energy expenditure in terms of its quality in addition to total exchanges of energy.

My definition rambles some and undoubtedly does not clarify the topic well. Perhaps the examples will help. As a native Nevadan with family and other strong attachments attracting me back as often as possible, I frequently pass through a familiar and favorite area a few miles west of Elko, in the northeastern part of the state, known as Carlin Canyon. Old highway 40 followed a horseshoe bend of the Humboldt River through this narrow, steep-walled canyon for a distance of about two miles. The two-lane bidirectional highway encroaches some on the river and the canyon itself, and there have always been problems keeping snow accumulations and rock slides off this narrow-curving road. Lacking sufficient space, the dual tracks of Western Pacific and Southern Pacific cut through the mountain enclosed in the loop with twin tunnels.

In 1972 I first noticed that extensive work was being done on the tongue of rocky hill that guides the river around this bend, and as time progressed, I have watched the evolution of a double tunnel about one-fourth mile long and two bridges to cross the river which connect stretches of Interstate 80 on each side to give a fast and safe four-lane divided highway for the estimated average 4,300 vehicles per day that travel this road. This 70-mile per hour super highway was finished almost in time to have the 55-miles per hour signs posted on the parapets.

My analysis of the project is necessarily incomplete for I l complete data. I do not feel that it is either trivial or superficial, however, for it forces us to look beyond the mere financial accounting for the enterprise. In terms of dollars it is hard to justify the more than $10,000,000 expenditure. At the risk of deadening you with statistics, let us look at how wisely our leaders invested for us in this project. At 4,300 vehicles per day and an operating cost estimated at 20¢ per mile for the 1.5 miles saved in the shortening of the route, it would take nearly 29 years to have saved, for the motorists involved, the 13.6 million dollars which the project cost. (Many of the 4,300 vehicles are trucks, so my cost estimate for operation is probably not too high). But even

if the operation could be considered to be only 10¢ per mile, in the nearly fifteen years needed to amortize the investment in savings, the value of the project, deposited at only 5% interest compounded annually would have provided a sum equal to the total cost. If we had just wanted to make work for people, it would have been just as well to set the workers out in the nearby desert with one gang digging holes and the other half filling them in. The analysis of the energy situation is even more critical and equally dismal. If I am to do an analysis of invested energy, even without specific reference to quality, I would need to know the amounts of energy invested in steel production, kilning of cement, transporting and assembling these in this remote site and the latent energy value of fuels and explosives consumed in tunneling, quarrying, grading and surfacing, and in the wooden forms and asphalt paving used. This information is virtually impossible to obtain after the fact. Only one of the four subcontractors honored my request for information and even this was sketchy. The specifications for the project, as provided by the State Highway Engineer, were of value, admittedly limited, but allowed me to conclude with confidence that a minimum of 75,000 MWh was spent in these ways.

Another tool for analysis is to calculate an equivalence factor relating energy to money. Dividing the annual national gross energy consumption by the GNP gives us, during this period, about 60 to 70 MJ per dollar, or in more familiar terms, about 15 to 20 kWh per dollar. This indicates better that 200 thousand MWh and I choose to inflate this by a factor of two for a project that is so energy intensive as compared to other ways we spend money and energy in our present industrial or private world. Thus, we reach 400 million kWh.

The 4,300 cars per day now traveling 1.5 miles less will be saving about 6,500 miles per day in travel. If they average 20 miles per gallon we are saving about 320 gallons of fuel per day. Gasoline releases about 43 kWh per gallon, so we are saving some 14,000 kWh per day. At this rate our invested energy would be paid off in some 28,000 days or about 78 years. If automobile performance improves, and it must, it will take even longer to amortize our energy investment. With the changing patterns of travel which are suggested by the most recent energy conservation policies being considered for adoption in Congress, we can expect there will never be an energy pay-off on such a project. Having shown itself to be a bad energy investment, as far as total consumption is concerned, judgement would dictate that we write the project off on that basis alone. We may have preserved some of the relatively high-quality gasoline or diesel fuel with the use of coal in smelting steel but we sacrificed energy quality in using exotic explosives.

Another kind of project currently on the boards that may presage much future activity relates to the upgrading of such fossil reserves as oil shale, tar sands or heavy oil. It is not entirely clear whether there are no plans going forward to extract a liquid fuel from the shale deposits on the western slope of these Rockies, and it is also not clear whether the delays would be due to financial or energy cost/benefit analyses, or other environmental consequences. We would need to be sure that a project set up to extract such fuel would actually be a net energy producer when all of the externalities are included. I can provide some better data from a recent report of proposed development of a heavy oil extraction facility in Alberta. Heavy oil, which abounds through certain areas of the northern prairie, is too viscous to be extracted as a liquid and is to be heated with steam to render it fluid. The energy source for the process steam is coal - also abundant. But it will require about one-third as much energy derived from coal as can be realized from the oil, for in addition to simple extraction, the long molecules must be cracked and hydrogenated if it

is to be refined to fuel grades. Thus we are subsidizing the production of a portable liquid fuel by about one-third of its energy value even before we consider the other subsidies of strip mining and transportation of the coal, manufacture and erection of the plant and ultimate transportation of useful products to market and disposal of the so-called waste. All of the land disrupted in these operations is a potential source of solar-derived energy, even in growing plants, and this energy must be counted into the subsidy. Any other effects, such as reduced quality of water or air which will require energy-expensive operations to refine them, go on the debit side of the ledger. The social disruptions from the building and eventual decay of a boom-town in the fragile natural environment have some sort of energy equivalents, and it is not unlikely that both quantity and quality of energy will be sacrificed for the opportunity to have more gasoline to drive through some tunnel we did not need.

Another similar project up my way is the so-called tar-sands development which produces synthetic crude oil from the bitumin-laden sand. We hear about the abundance of the resource which is variously touted to contain enough potential to meet North American demands (at present rates) for decades and, if kept wholly for Canada's use, for centuries. But less than 3% can be extracted by surface operations - the only process yet developed. This is very energy consumptive and disturbs many equilibrium conditions, both natural and social. The coke which is a by-product is so contaminated with sulfur that to this point it cannot be burned for process energy and so we must use some of the refined output product, reducing the net gain, or import coal. In addition, the enrichment of the tar to pentanes plus requires the use of vast amounts of methane which is itself in limited supply and extremely useful in its own right as an energy source. If we spend any significant amount of methane in this upgrading process, the reserves of which are now estimated to be depleted by about the end of the century, we may fine that we have built a good many homes equipped for gas heat, and in which the gas runs out before the mortgage does.

These are examples of possible problems which can be explored by students at least through the secondary school levels. Because I am permitting you to write the text of the presentation, I can leave it to you to identify instances where you can apply the principles involved. The laws of nature, especially the principles of thermodynamics and nature of limits, are absolute and immutable. Values can change, and we see that they do, so we must not allow ourselves to yield to myths of what people will or will not do. We know more clearly the limits which natural law imposes.

INTERNATIONAL ENVIRONMENT

18/19/20

A LOOK AT THE ENVIRONMENT IN THE PEOPLES REPUBLIC OF CHINA*

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In the first century, B.C., the Chinese "Record of Rites" warned against man's polluting the environment.[1] Further, we know that Chinese land has been cultivated for thousands of years and that it is still fertile. In fact, the land today is supporting double and triple cropping in many places. But it would not be accurate to suggest the Chinese have always been the greatest benefactors for their environment. They cut most of the forests and they raped the land in some ways during their history. They dumped wastes into streams. So, it has been a mixed experience.

China today is considered by many to be an environmental model for other nations. Since the Communist takeover in 1949, the people have shown a sensitivity for the environment: Indeed, there are many forces that have operated to make it so. Economic forces for one thing have operated for thousands of years in China just as elsewhere and many actions of Chinese historically and recently have been expedient in terms of economics. Another force has been the poverty of the people, a force that may have been a blessing in disguise since the people have had to have life styles that were in harmony with nature.

China has an enormous population and must control it if food production is to keep up with population. This means that a family typically has no more than two children. The low level of economic development has meant that people live in modest homes or apartments and have no heating or air conditioning. (Only one hotel on our trip was air-conditioned and that only part of the day.) No one owns an automobile and so the people walk, ride bicycles; take buses or trains. They live close to their work, their schools, and markets. Their incomes are low so they do not have refrigerators, dryers, washing machines, and powered can openers. Television is shared in the "sun flower" courts. They may also share their cooking facilities. They do not bring home bags of packaged convenience goods but rather only the necessities and these are not packaged. Even live chickens are carried in a mesh bag. They have little with which to litter. (I saw one Chinese carry peanut shells to a receptacle rather than throw them on the ground.) Clothes are laundered frequently and hung out the window on a pole for drying. Food is largely non-processed although there is some limited amount of processed food available. The people do not do a lot of traveling and do not go far for entertainment. Their life is a simple life.

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* The author was one of nine Minnesotans who were sponsored by the Northwest Foundation in the summer of 1976.

[1] Leo A. Orleans and Richard P. Suttmeier, "The Mao Ethic and Environmental Quality," Science, Vol. 170 (December 11, 1970), pp. 1173-1176.

This discussion of China's environment will be based on a number of secondary sources as well as personal observations made while in China for three weeks during the summer of 1976. A visitor sees only a little bit of China in three weeks and when on a first trip there is so much to see that it is difficult to concentrate on one area of interest.

Ideology

Mao Tse-Tung's Quotations are probably the proper "scripture" for these remarks on ideology.

> "To make China rich and strong needs several decades of intense effort, which will include, among other things, the effort to practice strict economy and combat waste, i.e., the policy of building up our country through diligence and frugality." (February 27, 1957)

> "Diligence and frugality should be practiced in running factories and shops and all state-owned, cooperative and other enterprises. This principle of economy is one of the basic principles of socialist economics." (1955)

> "Wherever we happen to be, we must treasure our manpower and material resources, and must not take a short view and indulge in wastefulness and extravagance." (January 10, 1945)

While Mao promoted progress, he imposed his ethic of frugality. Production was to remain under human control and technical development was to be dependent upon social development, not vice versa. The environment was to be utilized, of course, and the land was expected to yield more and more. There had to be therapeutic action, also, and this took shape in afforestation, water conservancy, land reclamation, sanitation, and public health.[2]

Mao's ethic of frugality and non-waste was implemented in many ways. Research was undertaken to help the nation reclaim and recycle wastes and to develop natural resources. Campaign after campaign prevailed upon the people to take pride in their cities, to salvage everything, to waste not.

Mao's ideology was widespread as a result of the political system, the public campaigns, and the educational systems. Students at all levels learned not to waste and they learned that China's survival depended in part upon taking care of their land and water. Decision-making among governmental agencies reflected the urgent need to care for the environment. Ministers of Public Health, Labor, Metallurgy, Coal, and other offices were responsible for implementing the ideology. Actually, explicit government regulations concerning the environment were not introduced until the 1970's. Health measures had early priority and later anti-pollution measures were adopted. In 1974, the Office of Environmental Protection was established and placed under the State Council. In addition there are regional bodies that regulate these matters. But even without legislation there were environmental concerns from the beginning of Mao's reign. These were largely brought about as a result of the health concerns and also as a result of the economic necessity to be frugal.

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[2] Ibid. pp. 1173-1176.

Population and Health

It is appropriate to consider population and health early because, as has been suggested, the health of the population was an early concern of the Mao regime. Many government officials had responsibilities of carrying out programs that improved health conditions. Many of these related directly to the environment. Sanitary conditions were deplorable in the days before 1949. People did not know how to handle night soil properly; they spit upon the sidewalks; there were flies and rats; garbage was piled in the streets.

Since adequate medical facilities were lacking, the Chinese programmed for preventive medicine. Massive campaigns were launched against flies, rats, mosquitos, and sparrows. Visitors can attest that the campaigns were successful. (I saw only a few flies and those on some manure at a commune.) When it was recognized that the sparrows had been eating many harmful insects, sparrows were replaced on the "Most Wanted" list by something else. Extensive clean-up campaigns were undertaken and still are. ("Grasp the patriotic health movement several times a year.") People were taught how to handle night soil so as to avoid health problems. Rivers and lakes that had been dumped into for centuries were cleaned. New wells were dug. Latrines were built. People were taught personal hygiene. When raw sewage that was dumped into the fields brought flies, a new process for hauling sewage was developed. Sewage facilities in most cities were installed and these took their place alongside traditional facilities.

Family planning has been instituted to control population growth as the food: population relationship is critical. A public attitude of strict adherence to a moral code that encourages delay of marriage well beyond the teenage years is in effect. There are wide-ranging state publicity programs that promote birth control. These utilize public address systems, brochures given newlyweds, classes for expectant parents, and discussion groups designed to elicit 'voluntary' adoption of birth control. A network of governmental family planning services implements the various programs.[3]

Cigarettes are still produced and consumed in China. One Chinese told me that a larger number of peasants smoked than did city workers. A doctor reported to our group that there are no rules against smoking but people do know that smoking is injurious to their health.

Concern for health worked to the advantage of the environment as the improvement in sanitary conditions meant improvement in environmental conditions. Further, there must have been some value in attitudinal changes that undoubtedly accompanied the changes in sanitation.

Agriculture

The rural sector, where eighty-five percent of the people live, is one of the areas of biggest environmental concerns. One concern in particular is the matter of insect and weed control. As mentioned earlier, China launched huge campaigns to rid the nation of some pests. They have used most kinds of pest and weed control, including some small amounts of aerial spraying. They still use, I believe,

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[3] Virginia Li Wang, Family Planning in China, Science and Public Policy. (April, 1976), pp. 173-174.

DDT. On the other hand, they banned aldrin, dieldrin and endrin in the 1950's because of their persistency and toxicity.[4] Their pest control programs have been on a large scale and they have used at least 100 different kinds of sprays. They have learned to use these with great care and more importantly perhaps, they are experimenting with the mass rearing and release of insect-egg parasites.[5] One interesting innovation was observed by a visitor in Kwantung Province where 220,000 ducks were raised by the Institute of Entomology. The ducks were herded through the rice fields at saturation densities where they consumed about 200 insects per duck per hour. The process cut the use of chemical insecticides on early rice from 77,000 kilograms in 1973 to 6,700 kilograms in 1975.[6] On weed control, some Chinese state that the best method is crop rotation.

Another environmental concern in agriculture is the use of chemical fertilizer. China has always been a big user of organic materials and even today organic fertilizers take care of about 70-80 percent of their needs.[7] All kinds of organic materials are prepared for the crops: night soil, garbage, silt, manure, green manures, and various other wastes that are composted or treated and then applied to the fields. But the Chinese have enormous needs for food and so they have started to use chemical fertilizers in order to improve the yields. One estimate of chemical usage indicates that it has increased from three million tons in 1960 to over thirty million tons in 1974.[8] Some of this chemical fertilizer is imported and China is also importing turn-key plants for the manufacture of chemicals.

The use of organic materials, despite the increase of chemicals, is still impressive to the visitor. Composts sites are seen everywhere, and one can see grapevines located near a pigpen in order to take advantage of the manure that will wash out of the pens. The vines, incidentally, also provide shade for poultry. Pigs are fed garbage and are sometimes located near a processing plant, such as a sweet potato starch plant. Pigs are household garbage disposals.

Resources

Article 6 of the PRC 1975 Constitution states the following:

> "The state sector of the economy is the leading force in the national economy."
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> "All mineral resources and waters as well as the forests, undeveloped land and other resources owned by the state are the property of the whole people."

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[4]Robert L. Metcalf, "China Unleases Its Ducks," Environment, Vol. 18 (November, 1976), pp. 15-17.

[5]Ibid. pp. 15-17.

[6]Ibid. pp. 15-17.

[7]Roger Blobaum, "How China Uses Organic Farming Methods," Organic Gardening and Farming (July, 1975), 5 page reprint.

[8]Alva Lewis Erisman, China: Agriculture in the 1970's, in A Reassessment of the Economy, Joint Economic Committee (U.S. GPO, Washington, D.C., July 10, 1975) pp. 324-349.

"The state may requisition by purchase, take over for use, or nationalize urban and rural land as well as other means of production under conditions prescribed by law."

When the first Constitution was written (1954), the Chinese had little idea of the extent of their natural resources. During the early period, however, the Chinese and the Soviets collaborated on comprehensive expeditions throughout the nation. These expeditions were highly organized and included examinations of water, minerals, soil, and other matters such as power potential.[9] As a result, the Chinese leadership has been able to make resource plans for their country, something that would have been difficult without these expeditions.

The Mao ethic frugality has been reflected in the way resources have been managed. In energy, for example, waste coal dust is gathered and molded into small blocks of fuel for cook stoves. Rice straw is sometimes used for cooking in the rural areas. The savings resulting from not heating or air conditioning houses, apartments and other buildings has to be enormous. Bicycling instead of driving results in more savings of fuel. The doctrine of self-sufficiency means that there is less cross-hauling and again there is a saving of fuel. Hydro-electric stations have been built, often in conjunction with flood control and irrigation projects. At one of these near Yangchow, special ponds had been constructed to save the fish. Small rural installations have been vital in producing electricity for homes and the large producers of electricity have been able to concentrate on industrial uses. There is experimental work going on in the solar area: Tibet with its 3,000 hours of sunshine is a good place for this application. Experimental cook stoves have been made and sold in several provinces.[10] (A solar stove boils water in twenty minutes.) Biogas is produced in many sectors.

Land reclamation was considered to be a great potential but apparently it has proven more difficult than originally supposed. (We did see a tea plantation near Wusih that was gradually taking over the mountains in the area.)

Untold millions of trees have been planted in recent decades. Mao directed the people to "make the motherland green" and the visitor has no difficulty in seeing the results of their efforts.

In addition, there has been some attention, apparently small, given to wildlife. Pandas, golden monkeys, goat antelopes, and wild horses are protected and so are paddlefish and pheasants. Little attention has been given to specific plant life as far as is known.[11]

Recycling

"Chinese society today is an immense ec[redacted] process."[12] The level of economic

[9] Orleans and Suttmeier, op. cit., pp. 1173-1176.

[10] Vaclav Smil, "Intermediate Energy Technology in China," Bulletin of the Atomic Scientists (February, 1977), pp. 25-31.

[11] Leo A. Orleans, "China's Environomics: Backing Into Ecological Leadership," China, A Reassessment of the Economy, Joint Economic Committee (U.S. GPO, Washington, D.C., July 10, 1975), pp. 116-145.

[12] Metcalf, op. cit., pp. 15-17.

development has created a force toward recycling. "Convert all wastes to treasures." Whether it is the household, the production brigade of the commune or the factory, recycling is the way to stretch the resources. "Recover waste materials, waste residues, waste liquids and waste gasses," is the message repeated over and over again. The results are striking. In 100 days, 90,000 workers dredged 403,000 tons of mire from local streams and distributed it over crops.[13] In Canton, a commune recycles human waste, manure, wood, glass, chemicals, and kiln gas. Furnace cinders are used as fill. The garbage from Shanghai is used by 109 neighborhoods to fertilize vegetables for the area.[14] City collection points for garbage and street sweepings are utilized. Factory B may use wastes from Factory A and Factory C may use waste from Factory B, etc.

Litter is not ugly: It is useful! Cities look drab but there is little litter to be seen. There are few if any non-returnable containers, no automobile junkyards and few plastic items to be strewn about.

Reclaiming and recycling has become a part of the Chinese way of life. Resources are saved. Economic progress is facilitated. Production is held at a lower cost. It seems like an obvious "all-win" solution.

Industry

Industry is one of the big participants in the "multi-purpose" or "comprehensive" recycling program. Metals, gases, liquid residues, oils and scrap are recovered. Products are made from recovered material. In Fukien province, there were no cotton plants and the people built a plant that used fibre pulp.[15] The Talien Steel Mill built ten small factories to use its recovered wastes.[16] The "turning wastes into treasures" concept has been an effective way of motivating the managers of factories and communes since managers are responsible for running efficient plants, and recycling provides a real potential for extra revenue and/or lower costs.[17]

Industry seems to have little in the way of elaborate pollution control equipment. Most of it is apparently made at each plant facility. This, of course, is in line with the Chinese concept of self-reliance. In the early days there was relatively little concern about air pollution. Actually, there were not a lot of factories, but even so, smokestacks were a good sign, just as they once were in the United States. Also, relatively few people lived in the cities so there was not a great concern about air pollution. But in recent years the government has become concerned and has done something about it. Some factories have been moved from inside the cities to points outside. New plants are located more carefully. While economics often may be an overriding concern, pollution is also a factor to consider.

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[13] Orville Schell, "China's Way with Waste," Source not known.

[14] Blobaum, op. cit., 5 page reprint.

[15] Schell, op. cit.

[16] Chi Wei, "Turning the Harmful into the Beneficial," Peking Review, No. 4 (January 28, 1972), pp. 5-7.

[17] Orleans, op. cit., pp. 116-145.

There have been other factors pressing toward dispersal of plants: Tensions between China and the USSR dictated defense needs, and there were the desires to be self-sufficient and to improve life in the backward areas.[18] Water pollution was always considered more serious than air pollution and plants are often located so as to minimize the water problems. Fortunately, most of the badly polluted areas were confined to a few areas. In addition to corrective measures, there have been industrial programs that reclaimed land as they prepared for production. One refinery turned a desert-like area into a very livable area with trees, neat homes, and good water supplies. Having control over industry gives the government the advantage of being able to implement policy, whether the policy is desirable or undesirable.

Intermediate Technology

Although E. F. Schumacher (Small is Beautiful) has not worked with the Chinese on intermediate technological concepts, his rules seem to have been followed.[19]

1. Make things small wherever possible.
2. Reduce the capital-intensity and increase the labor factor.
3. Make the process as simple as you can.
4. Design the process to be non-violent (environmentally).

Intermediate technology aims for the masses to produce as opposed to mass production. It introduces technology in a way that allows for large scale labor participation and low scale capital investment. It helps to increase the standard of living and it can reduce many menial tasks. Peasants and workers acquire skills that can be utilized later with more advanced technology. Savings from small machine use can be significant.

It would appear that the Chinese have used the intermediate technology concept to good advantage. Here are some examples. (1) Pollution control equipment is often made in local shops. (2) A 7½ HP diesel engine is produced by the thousands and is used for walk-behind tractors, for motorized carts and for many other purposes, and school children learn how to take the machine apart and repair it. (3) There are small factories in every commune: On the Hsin Hua Commune near Canton there were eighteen enterprises turning our $4.75 million of products, one a machine shop with thirty lathes. (4) There are small enterprises producing energy from coal, biogas, and water. The small hydro stations are a worthwhile application of intermediate technology, and they have helped a great deal to cover energy need. The biogas is made from dung, night soil, corn stalks, garbage and other wastes. It is converted in small units to gas.

Intermediate technology has been an attractive alternative for the less developed nations, and China in many ways exemplifies its utilization. The country has a very large labor force and limited capital. Still, with a desire to industrialize, increased amounts of technology are necessary and this is where the intermediate concept has been useful. The Chinese have used the "walking on two legs" idea, and this has promoted both urban and rural development, both traditional and modern pollution control methods and low and high levels of technology.

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[18] Orleans, op. cit., pp. 116-145.

[19] E. F. Schumacher, "We Must Make Things Smaller and Simpler," The Futurist, Vol. VIII (December, 1974), p. 281.

As the visitor travels through the countryside, he is impressed with both the stated desire to increase technology and at the same time with the large amounts of labor being used everywhere. At the commune the signs read, "Mechanization is the key to the future." But in the fields one sees few pieces of equipment, few animals, but many human beings. Intermediate agricultural machines are seen at exhibits and in developmental stages and larger units can be also seen at exhibits. Intermediate technology can continue to be extremely useful to the Chinese, especially in their agricultural areas as there are many advantages to this non-violent technology:

Ecologically sound
Small energy input
Low pollution rate
Village emphasis
Integration with nature
Technical boundaries set by nature
Labor intensive
Efficiency increases with smallness
Few accidents
Quality criteria highly valued
Small units self-sufficient[20]

Concluding Comments

In terms of the environment, China has a good overall record. Some of her record has been a matter of circumstances in that the level of development discouraged waste, the population was largely dispersed over a vast rural area, and the environmental situation was not intolerable when Mao came to power. Also, economic development has not been terribly rapid. Much of her record, however, has been planned as Mao protected the country from many of the abuses of economic development, and he helped the people to become healthy and adequately fed. Finally, her environmental record is proof that the Chinese leaders and people have been able to study, research, plan, and implement environmental concepts. So the record is good in part because it was difficult to do otherwise and in part because of a determination.

It is always hazardous to make predictions and this is especially true with China. Regardless, this writer would say that he feels the present China signals indicate a stronger push is in store for economic development. This need not result in environmental degradation since the country is equipped to handle the various kinds of problems. The change from the Mao to the Hua ethic could also mean a gradual diminishing of the frugality ethic and the development of a technical approach to environmental matters. Time will tell.

[20] John P. Milton, "Communities that Seek Peace with Nature," The Futurist, Vol. VIII (December, 1974), p. 268.

THE QUANTUM THEORY OF ENVIRONMENTAL EDUCATION

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Environmental education is a new focus and a new dimension in the academic arena which has generated a great deal of enthusiasm and interest in teachers, students, political leaders, and the general public throughout this country and around the world. Never in the history of education has any new movement advanced so rapidly and been accepted by so many in so short a period of time. In the 1960's the term was known and understood by very few. In the short span of a decade, the term "environmental education" is in common usage in many countries throughout the world. Where did it come from? What are its roots? Did it emerge solely as an outcome of the turmoil of the 1960's?

In an effort to find answers to these perplexing questions, I began to explore the growth and development of the Conservation/Nature Study Movement and of the School Camping/Outdoor Education Movement in this country. These are two separate and distinct components in our education system which have contributed much to American youth. However, as I delved deeper and deeper into these two educational movements, I found similarities and I developed a feeling that these were, in fact, the roots of environmental education. Yet, how could I support this feeling? What brought these two philosophical components into a central and single focus? What about the new dimensions of environmental education which did not appear in either of these earlier movements? As I groped and searched for an answer, I happened to come upon the work of the late Jesuit scholar and paleontologist, Pierre Teilhard de Chardin. In his monumental work, The Phenomenon of Man, Father Teilhard explains the evolution and development of new life forms by applying the theory of quantum physics and utilizing the principle of a "quantum jump" to illustrate how unique changes in living organisms occurred. Quantum physics, explained in very simple terms, states that various elements and components come together in a random series of steps, and there is, in essence, a collision of these various elements which results in an explosion or a "quantum jump"; and the new product resulting from this explosion is significantly different than the sum total of those elements which contributed to its creation. Here was the answer to my perplexing dilemma! The idea of applying the principle of quantum physics seemed to lend itself to my analysis and review of the Conservation/Nature Study Movement and the School Camping/Outdoor Education Movement in the United States and provided the theory which could explain how these two movements were, in fact, the historical roots of environmental education.

Let us now move on and examine the series of steps that brought us to that dramatic period in educational history in the late 1960's when environmental education became a reality. Since the Conservation/Nature Study Movement pre-dates the School Camping/Outdoor Education Movement by almost a hundred years, we will begin there.

CONSERVATION/NATURE STUDY MOVEMENT

Awareness Phase

I have chosen 1860 as the starting point, and the period from 1860 to 1890 I believe

to be the "Awareness Phase" of the Conservation/Nature Study Movement. In 1864 a New England Yankee, George Perkins Marsh, produced the great work, Man and Nature, which awakened in many the realization that Man is not a single and solitary figure standing above all other living and non-living things but rather an integral part of the system. The works of Emerson and Henry David Thoreau also received considerable attention during this period, although written earlier. For example, many of Thoreau's works were not published until after his death in 1862. In 1870 another of the more prolific and eloquent conservation writers began to make his mark: the great John Muir, who is most famous for his efforts to bring Yosemite into the National Park System. The work and writings of these men contributed much to develop this sense of awareness and set the stage for what was to follow.

Preservation Phase

The next identifiable phase of the conservation movement began in the 1890's, which, I feel, can be appropriately termed the "Preservation Phase." Two individuals stand far above all the others during this period. Gifford Pinchot, born in Connecticut in 1865, did much to popularize and define the need for conservation in this country. His influence was reflected in the actions and statements of the other individual who contributed so much during this period: Theodore Roosevelt, the Rough Rider who served as our twenty-sixth President, assuming office in 1901 and serving through 1908. From the point of view of conservation and preservation of natural resources, President Theodore Roosevelt's term stands alone in American history. Public ownership of forest lands, woodlands, and prairies increased from forty million acres to one hundred ninety-four million acres during his term of office. He established the National Conservation Commission to oversee and supervise natural areas. In 1908 he called the first White House Conference on Conservation.

Instrumental in much of this activity was Gifford Pinchot, the first Chief Forester of the United States and the only Bureau Chief of the federal government to serve as a personal adviser and confidant to the President of the United States. Mr. Pinchot introduced the concept of multiple use of forest lands. As a result of his work, our forests were to be viewed, not merely as a crop to be harvested, but also as a valuable resource for recreation, relaxation, research, and study. His efforts led to the next phase which began to emerge around 1910. I like to refer to this period of time as the "Nature Study Phase" of the movement.

Nature Study Phase

A great catalyst during this time period was the establishment of the American Nature Study Society in 1908 with Liberty Hyde Bailey, a horticulturist and great lover of nature, as its first president. The purpose of this organization was to develop an understanding and appreciation of the beauty, majesty, and mystery of nature. In 1914 one of the great champions of the nature study movement, Mrs. Anna Bostford Comstock, published the Handbook of Nature Study, which served as a tool and a guide for teachers and many aspiring young naturalists and is still considered one of the most useful references available. Mrs. Comstock's work, combined with other leaders in the American Nature Study Society, led to the next phase which began to emerge in the 1930's, and which I refer to as the "Education Phase" of the Conservation/Nature Study Movement.

Education Phase

In 1933, because of the Great Depression, the Civilian Conservation Corps was

established by an act of the Congress and provided three million young Americans with an opportunity to learn the value of forest lands and woodlands to human life. As a result of the C.C.C., many Americans became more aware of the need to learn about the interrelationships and interactions of living and non-living things. In 1933, Dr. William Gould Vinal, of whom you will hear more later, published an article entitled "Nature Clubs for Teacher Training," which suggested that natural areas be used as an extension of the classroom. This article appeared in Recreation Bulletin, a publication of The National Recreation Association. Another catalyst occurred in June of 1973 when Dr. J. W. Studebaker, United States Commissioner of Education called a conference on conservation education in Washington, D. C., to examine this new trend in greater detail. In addition, several government agencies, such as the United States Forest Service, the Fish and Wildlife Service, and the Soil Conservation Service, began to publish conservation education materials and hired specialists to implement that segment of their programs.

Curriculum Phase

All of this activity led to what I identify as the "Curriculum Phase" of the Conservation Movement which began to emerge in the 1950's. The establishment of the Conservation Education Association in 1953 did much to bring materials related to natural resource management into the school curriculum. The CEA also assisted colleges and universities in developing and implementing new courses of study. During this time period, conservation concepts were discussed and examined in classrooms and school laboratories across the country.

This approach continued to expand and gain additional acceptance into the 1960's when a broader orientation was introduced. Urban problems, life in the city and in the suburbs began to be explored and examined as a legitimate concern within the Conservation Movement. This brings us into the late 1960's. At this point, I would like to leave the Conservation/Nature Study Movement and begin to explore the evolution and development of School Camping/Outdoor Education.

SCHOOL CAMPING/OUTDOOR EDUCATION MOVEMENT

Recreation Phase

Like conservation and nature study, school camping and outdoor education also has a long list of leaders who contributed much to the development and enrichment of this unique fact of education. However, in searching for the origins of this movement, one individual stands alone and was, in my judgment, responsible for planting the seeds which, over the years, grew into outdoor education. He also played a role in the conservation movement and has been mentioned earlier in our discussion: Dr. William Gould Vinal, the Father of Nature Recreation, affectionately referred to by his friends and admirers as "Cap'n Bill"; twice president of the American Nature Study Society in 1922 and 1923; and president of the National Camp Directors Association in 1925 (now the American Camping Association). Cap'n Bill Vinal was born in Norwell, Massachusetts, on November 29, 1881, and died at his beloved Cape Cod on July 9, 1976. During his long and productive life, he combined the principles of nature study, recreation, and organized summer camping. For many years Cap'n Bill directed a summer camp, Camp Chequesset, at Wellfleet on Cape Cod where he demonstrated his approach. The philosophy and emphasis of his camp led him to form the Nature Lore School at Camp Andree, Briarcliff Manor, New York, in 1927. In addition, during the late 1920's and early 1930's, Cap'n Bill's influence was reflected in summer programs conducted by the Boy Scouts of America, the National Recreation Association, and served as the impetus for public schools to begin school camping experiences during the summer months. One of the first such programs was

conducted in the summer of 1934 for children from New York City; four thousand children per day, two days a week, participated in this pioneer program. Also, in 1934, a resident program was conducted for sixteen New York City boys at the Life Camps at Pottersville, New Jersey. The youngsters lived, worked, played, and learned together for one month under the direction of Dr. Lloyd B. Sharp, one of the giants in the outdoor education movement and one of Cap'n Bill's former students.

School camping, as a result of the early efforts of Cap'n Bill Vinal, began to win acceptance, and in the 1940's "school camping" had grown and matured into the field of outdoor education. The two best known centers at the time were located in the states of Michigan and New Jersey. The Battle Creek Board of Education established a year-round resident program at Clear Lake new Dowling, Michigan. The man who played the major leadership role in establishing the program was Dr. Julian W. Smith, another legend in the field, whose writings, lectures, and travels have influenced the development and implementation of outdoor education programs throughout this country and in many other parts of the world.

The Clear Lake Camp was established to serve the school children of Calhoun County, and the philosophy of Julian Smith was the basis upon which its program was built. Dr. Smith stressed education "in" the out-of-doors and education "for" the out-of-doors. Under the aegis of education "for" the out-of-doors, emphasis was placed on the teaching of outdoor recreation skills, such as archery, riflery, fly casting, fly tying, fishing, boating, and canoeing, to mention a few. The teaching of these skills was carefully integrated with the other subjects of the school curriculum, and a strong emphasis was also placed on social interaction and group living. It was believed that through this combination of outdoor recreation activities with other school subjects, opportunities would be provided for children to enjoy and utilize the out-of-doors more fully; and, freed from the artificial confinement of the classroom, children would assimilate more material in the other subjects.

While Julian Smith and his associates were developing and implementing this approach in Michigan, Dr. L. B. Sharp and his colleagues were conducting unique outdoor education program at the famous National Camp located at Lake Mashipicong in the northwestern corner of New Jersey. In Dr. Sharp's approach, more emphasis was placed on pioneer living skills, such as fire building, outdoor cooking, and the construction of temporary shelters, with a decentralization of these living units in order to enhance the small group approach to learning. The purpose of teaching the pioneer skills was to help the children feel more comfortable and at home in a forest setting and to develop an appreciation for our American heritage. The emphasis was placed on confronting students with real life problems and experiences. It was believed that, as a result of these experiences, school subjects would take on additional meaning. Dr. Sharp believed that which can best be learned inside the classroom should be learned there. That which can best be learned in the out-of-doors, through direct experience in dealing with native materials and life situations, should there be learned.

As I reviewed the major components of these two schools of thought, the campcraft and outdoor living skills stressed by L. B. Sharp and the recreation skills stressed by Julian Smith, I chose to identify the period of the 1940's as the "Recreation Phase" of the Outdoor Education Movement.

Curriculum Phase

With the dawn of the 1950's, both these schools of thought began to place more

emphasis on the method or process of teaching the traditional school subjects in an outdoor setting. The purpose of outdoor education in the 1950's became better defined as a means of enriching the curriculum and accelerating the rate of learning. Many colleges and universities across the country added courses intended to train future teachers in the techniques of field teaching. It was during this period of time that two of the larger resident field centers were established for training pre-service teachers. The New Jersey State School of Conservation was established in the spring of 1949 in Stokes State Forest to serve as the field campus for the six state colleges of New Jersey. Dr. E. DeAlton Partridge served as the first director of the School of Conservation. In 1950 Northern Illinois University established the Lorado Taft Field Campus in Oregon, Illinois, with Professor Paul Harrison as director. With these two centers setting the pace, other programs at other institutions of higher learning were also developed and implemented. The emphasis was on curriculum enrichment. The justification for removing youngsters from the classroom and taking them to an outdoor school was to help them to assimilate more cognitive material and, through experience, extend the retention factor.

In the late 1950's, another element appeared in the outdoor education movement, and this was the utilization of the school grounds as outdoor laboratories. This enabled many more children to participate in outdoor education experiences and did much to popularize the concept of utilizing outdoor areas at all grade levels. This emphasis on method and process in outdoor education has led me to refer to the 1950's as the "Curriculum Phase" of the Outdoor Education Movement.

Conservation Phase

During the early 1960's, another trend began to appear in outdoor education programs. Moving from the emphasis on curriculum enrichment, outdoor educators began to pay more attention to the development of attitudes relating to the proper utilization of natural areas. One of the main factors in causing this change was the administration of the late John F. Kennedy, a period of time I like to consider as the "Thousand Days of Elegance" in American history. During President Kennedy's term of office, more emphasis was placed on the identification of man's abuse of natural resources than, perhaps, at any other time in our country's history. This can be reflected in the excellent text, The Quiet Crisis, written by Stuart Udall, Secretary of the Interior during the Kennedy administration. Another catalyst was the appearance of the excellent work, Silent Spring, by Rachel Carson in 1962. This renewed interest in natural areas and natural resource management during the early 1960's paralleling the "Preservation Phase" of the 1890's in the Conservation/Nature Study Movement, caused many educators to reexamine and re-explore the school curriculum in an effort to make modifications intended to provide children and young adults with a better understanding of their place and responsibility within the total spectrum of living and non-living things.

Of the entire educational community, the group which appeared to be best equipped to provide these meaningful educational experiences intended to develop an appreciation for land management were those individuals engaged in outdoor education. Living in forest lands and woodlands was already a part of their lives, and their knowledge of school curriculum at various age levels was also an asset. Therefore, many outdoor educators made the philosophical shift from the cognitive emphasis of the 1950's to the conservation emphasis of the 1960's. The thrust in most outdoor education centers thus became attitude formation in conservation: a move from the cognitive to the affective. Granted, not all individuals engaged in outdoor education chose to make such a shift and some remained with the more traditional approach and continued to focus on curriculum enrichment. However, it is safe to say the vast majority of outdoor education programs in the 1960's moved toward an

emphasis on attitude formation in conservation. This leads me to refer to the 1960's as the "Conservation Phase" of the Outdoor Education Movement.

ENVIRONMENTAL EDUCATION MOVEMENT

However, in the late 1960's outdoor educators who had made the shift to attitude formation in conservation were beginning to feel a new set of societal pressures. These same pressures were being applied with equal force on those individuals active in conservation education. The pressures of the late 1960's, which were felt by the leaders in both outdoor education and conservation, were caused by an increased public awareness of the problems of air pollution, water pollution, noise pollution, landscape pollution, overpopulation, and excess energy demands. It soon became apparent that it was not possible for educators to focus solely on natural resource management and that it was necessary, when speaking about forest lands, woodlands, and open space, to make reference to life in the suburbs and the cities. As the environmental problems increased in significance and number, an educational phenomenon began to take place. These external pressures in our society forced the philosophical components of outdoor education and conservation education on a collision course, and in the late 1960's there was a mixing and a blending which resulted in a great explosion or "quantum jump" which produced a new product, a new philosophy, a new approach: environmental education.

It is my belief that the field of environmental education, which has brought about dramatic changes in school programs and new courses of study at the college and university level, would not have come into being at such a sophisticated level and moved at such a rapid rate of development were it not for the existence of the Outdoor Education Movement and the Conservation Education Movement.

There will be some who may disagree with my historical analysis and seek a rationale and a series of events which would imply that environmental education was created separately and apart from the events described thus far in this discourse. This is to be expected since no analysis of historical events ever received universal acceptance. Yet, I submit that a close and concise analysis of all the factors involved leads ultimately to the conclusion which I have shared with you.

Let us now look at this new dimension of school programs which we call environmental education. What is it? Where does it take place? At what grade levels should it be introduced? Why is it necessary? First, it is definitely not a new subject area to be added to an already overcrowded curriculum, but rather a refocusing and a new emphasis within the framework of existing school programs. Environmental education can and should take place in four learning environments: the classroom, on the school grounds, in the community, and in natural areas. The educational experiences utilized to develop an environmental sensitivity should be found within the four broad curriculum areas of humanities, social studies, natural and physical sciences, and outdoor pursuits. The teaching techniques employed should stress the formation of concepts which leads to the development of attitudes and values: affective learning. This is one of the components that makes the focus of environmental education new and different from the more traditional cognitive approach, which has sometimes been defined as a series of facts passing from the notes of the teacher to the notes of the students without passing through the minds of either.

In environmental education, an attempt is made to focus on real life situations and relate cognitive material to the life style and needs of individual students at every grade level for the purpose of motivating them to work toward the solution of the environmental problems which threaten life on this planet. Students participating in environmental education programs should, as a result, realize the need

to use our natural resources more efficiently than they have been used to date. The Dymaxion Theory of Dr. Buckminster Fuller which, simply stated, is doing more with less, should become a pattern of their lives. Of course, this is not always accomplished as easily as it is to state it here. Nevertheless, this should be the hallmark of environmental education.

In the 1970's, environmental education programs are not limited to one or two school districts or to one or two states or even to one or two countries. Rather, it has become a recognized and necessary approach to education by academicians throughout the world. A catalyst which contributed much to developing this global awareness was the conference held in the fall of 1975 in Belgrade, Yugoslavia, under the aegis of U.N.E.S.C.O. That conference was very capably chaired by Dr. William B. Stapp of the University of Michigan and produced the now famous Belgrade Charter, a world master plan for environmental education, approved by delegates from sixty-five countries. Efforts are now being made to implement the results of that outstanding conference in Yugoslavia.

It is interesting to note that environmental education may prove to be the catalyst that not only saves the human race from extinction, but also may serve to unite all the people of the world in a common effort to find solutions to the perplexing and difficult problems that threaten life on the planet. The seriousness of the environmental problems has forced us all to overlook differences in political ideology in order to protect the life support systems of Spaceship Earth.

Let us hope these fine efforts that were started many years ago by the leaders in the Outdoor Education Movement and the Conservation Education Movement and more recently brought into sharp focus through the deliberations in Belgrade, will result in changes in behavior and attitudes among people everywhere. All mankind must be made to realize the fragile and finite nature of this little speck of cosmic dust we choose to call planet earth. If the message of the Environmental Education Movement is ignored by the people of the world, then the words of the character, Jaques, from As You Like It by the immortal Shakespeare may prove to be a fitting epitaph for the human race: "sans teeth, sans eyes, sans taste, sans everything."

BIBLIOGRAPHY

Clepper, Henry. Origins of American Conservation. New York: The Ronald Press Co., 1966.

Coyle, David C. Conservation. New Brunswick, N. J.: Rutgers University Press, 1957.

Landsmann, Leanna. "Children for a Conserving Society," Instructor, Vol. LXXXV, No. 1 (August, 1975).

McInnis, Noel and Albrecht, Don (Ed.). What Makes Education Environmental? Louisville, Ky.: Data Courier, Inc., 1975.

Smith, Julian W., Carlson, Reyn .d E., Donaldson, George W. and Masters, Hugh B. Outdoor Education. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1963.

Swan, James A. and Stapp, William B. (Ed.), Environmental Education. New York: Sage Halsted Press, 1974.

Tanner, R. Thomas. Ecology, Environment, and Education. Lincoln, Nebraska: Professional Educators Publications, Inc., 1974.

Viral, William G. Nature Recreation. New York: McGraw Hill Book Co., 1940.

_____. "The Growth of the Concept of Nature Recreation," Nature Study, Vol. 28, No. 4 (Winter 1974-75).

POPULATION - POPULATION EDUCATION

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POPULATION AND ENERGY

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During the recent media blitz on "energy, the nation's attention was focused on the consumption and conservation of scarce world energy resources. Th impact of energy policy on population patterns was barely mentioned. The Population Institute suggests that it is important to recognize the interrelationship between energy use and population, and to plan for the growth and environmental impacts of energy policy.

How Population Affects Energy

In 1950 there were 2.5 billion people in the world. Today there are over four billion, a 60 percent increase in twenty-seven years. Between 1950 and 1974, per capita energy consumption for the different world regions increased between 100 and 600 percent. Thus, energy consumption has grown faster than our rapidly increasing population. In other words, not only are there more people to consume energy, but each person is consuming larger quantities.

High consumption levels characterize the developed world. Industrialized countries, with 30 percent of the world's population, consume 80 percent of the world's energy. In contrast, India, with 15 percent of the world's population, accounts for 1.5 percent of the energy consumption. Yet, even among industrialized countries, the consumption level of the United States is unique.

The United States, with its population of 216 million people, uses more energy than the four major industrial countries combined (the United Kingdom, Japan, the U.S.S.R., and West Germany), totaling over 500 million people. Our energy consumption is nearly 40 percent above that of Western Europe countries with a similar standard of living. In the last twenty-five years our energy consumption has doubled, and it is estimated that in the last quarter of the 20th Century, we will consume more energy than we have in our entire history.

Potential population growth in the United States will have the same impact on the earth's energy supplies as the doubling of the present entire Third World's population. The Unfinished Agenda, the recently published report of the Environmental Agenda Task Force of the Rockefeller Brothers Fund, estimated that each baby born in the United States consumes as much as sixty times the energy during its lifetime as an infant born in South Asia.

The world's population is growing at an annual rate of about 1.8 percent. At this rate, there will be an additional four billion people in the world by 2015 who will need energy for heat, food, transportation, housing, and employment. Dennis Hayes, energy specialist for the Worldwatch Institute, estimates that even if we "optimistically assume that the world's population will level off after one more doubling and stabilize at eight billion by 2025, and if we conservatively assume that per capita energy use will then amount to one-third the current U. S. 'level' the world will not be able to safely meet its demand for energy with existing resources or technologies." The recent study by the DIA indicated that oil supplies cannot possibly meet this need. Hayes says that if energy were all provided by coal "the atmospheric inventory of CO_2 would

increase about four percent a year (which would) soon alter the heat balance of the entire planet dramatically...(and) if the postulated energy demand were met with nuclear fission, about 15,000 reactors as large as the biggest yet built would have to be constructed - one new reactor a day for fifty years."

The United States population will continue to grow for at least fifty years. According to the median projections of the Bureau of the Census, there will be 300 million people in the U. S. by 2025. Zero Population Growth, which includes illegal immigration in its calculations and, therefore, estimates a U. S. population of 324 million in 2025, projects that "even if per capita energy consumption does not increase at all during that time, the United States would still need at least 58 percent more energy fifty years from today." In contrast, if the United States reached zero population growth by 2008, there would only be a 14 percent increase in demand for energy.

The energy plan put forth by President Carter in 1977 proposes a reduction in the annual energy growth rate to less than two percent. It is questionable whether the proposed conservation measures can do much more than maintain the current 3.6 percent annual rate in light of the growing U.S. population. It seems unlikely that the energy requirements of an additional 84 million people can be met at the proposed growth rate.

It is also possible that as the United States grows, more consumers will demand more energy per capita. As our natural resources diminish, we will need to expend more energy to obtain less accessible minerals and to irrigate and fertilize marginal farm lands. (It is important to note that these needs are sometimes mutually exclusive. Conflicts between agriculture and the coal mining industry have already surfaced in Colorado, Wyoming, Montana, and the Dakotas as they compete for a limited water supply.)

Our food production and preparation is especially dependent on energy. According to the Center for Science in the Public Interest, Americans now use 12 percent of their energy budget for food. Many agricultural crops use nitrogen fertilizer which is made from scarce natural gas. Crop drying, an essential preservation procedure, also utilizes natural gas. Food prices will continue to rise as the energy to produce it becomes more expensive, and as our increasing population's demand for food and energy rises.

There are some counterbalancing population-related forces. If the trend continues to smaller families, smaller housing units and smaller cars that use less energy will become more widespread. As the baby boom generation ages, the population of the United States will age. The Energy Policy Project of the Ford Foundation concluded that "an older and wealthier population will probably consume more services and high quality goods which tend to be energy conserving." It is possible that after 1985 when the baby boom has been absorbed into the work force the energy requirements of employment will lessen. In addition, many of the structures and facilities needed to meet the demands of the population have already been constructed. (It is important to remember that an aging and wealthier population also spends more money on leisure pursuits and labor saving devices that use a considerable amount of energy. This may offset any potential savings.)

How Energy Affects Population

Policy decisions about energy and the development of new energy sources affect patterns of population growth. We have a ready witnessed how federal agricultural

policy with its research and program support for large scale labor saving technologies resulted in massive rural to urban, and southern to northern migrations. It is likely that the proposed development and conservation efforts, coupled with the rising costs of energy, will have similar effects.

The inexpensive energy of the 1960's led to patterns of urban sprawl. As energy costs rise, those places which offer a cost advantage through conservation will be preferred, and cities will become increasingly dense. The recent migration trends away from the large industrial centers will be reversed.

The proposal for higher gasoline prices and a ten percent reduction in gas consumption by 1985 may accelerate this move. (It is possible that a shift to compact cars with high gas economy would reduce this impact.) The Energy Policy Project of the Ford Foundation predicted that higher gasoline prices would put an end to long distance commuting. The 55 mph speed limit has already changed the mileage limits of commuting times. Places that offer mass transit will be preferred as private modes of transportation become more costly.

It will become increasingly expensive to live in outlying areas. At present, fewer than 400 bus systems operate in cities under 50,000 people. Rural areas are especially dependent on the trucking industry which will surely raise their prices significantly to meet their rising gas costs. Single family homes will be increasingly expensive to maintain.

Heating and air conditioning requirements are primarily related to the type of dwelling unit. A report of the CEQ and HUD estimated that an entire community of single family homes needs over 400 million BTUs annually per dwelling unit for transportation and residential heating. In contrast, a highly planned, high density city, where the majority of the people live in high rise or walkup apartment buildings, needs just over 200 million BTUs per capita. They concluded that "planning alone can save nearly fourteen percent of total new energy consumed, but planning combined with increased density can save up to forty-four percent." (The Cost of Sprawl, Executive Summary, 1974, p. 5.)

Higher population density means lower energy consumption. For example, New York City consumes only about half the energy per resident than the rest of the United States. The entire New York City region which contains almost ten percent of our population, consumes less than seven percent of our energy. Unfortunately, high population density is also associated with unemployment, inadequate housing, poverty, crime, crowding, and the countless other problems of our modern cities.

Last year marked the first time that the majority of the U. S. population lived in the South and the West. The population of the South has increased 9.6 percent since 1970, the West 10.7 percent, but at the same time, the Northeast only grew by .9 percent. The continued pressures on the energy supply will accelerate this population shift.

The Northeast is likely to continue to shrink in population size and industrial importance. President Carter's proposal for a uniform natural gas price would only temporarily relieve the pressure on the area. Seventy percent of this region's energy is petroleum based, and two-thirds of it has to be imported. The proposed reduction in oil imports to less than six million barrels a day by 1985 will especially affect the area's petroleum-related industries. They are likely to move closer to refineries and large supplies of natural gas.

(It is possible that this trend could reverse itself if nuclear and solar energy is developed or if oil is obtained from the outer continental shelf.)

The population of the South and the West will continue to grow. Industries and families will move to take advantage of the warmer climates and inexpensive energy. At the present time, the energy in the Southwest costs three-fifths of the national average. The proposed sixty percent increase in coal production will have a major growth impact on the Rocky Mountains and the Northern Great Plains. This migration is likely to continue well into the next century as solar energy becomes more prevelant and energy-intensive industries relocate to sunnier areas.

The proposed emphasis on the development of energy sources will especially affect rural communities in these regions. A 1975 survey by the Denver Federal Regional Council found that of 131 communities to be impacted by energy projects, forty-five percent had less than 1,500 people and were located more than 100 miles from a metropolitan area and only eleven percent had populations over 5,000. These areas must rapidly respond to an influx of people instead of having the usual time to absorb population growth due to natural increase and normal migration patterns.

The large scale development of energy sources in sparsely populated areas results in "boom towns." During the planning and construction phases of a project, employment and population increase r pidly from a generally static base. The influx of personnel causes inflation, revenue shortages, congestion, and high demands on water and sewer facilities. The Denver Research Institute estimates that an annual growth rate of ten percent will strain local service facilities, and a fifteen percent rate will actually cause breakdowns in the area.

Housing shortages are especially acute. "Aluminum ghettos" of mobile homes are a common sight in boom towns. In Alaska, the price of a housing lot went from $450 to $10,000 during the pipeline construction.

Between fifty and seventy percent of the construction workers bring their families with them. The schools in the area become overcrowded and medical services in the area are stretched beyond their capacity. The spouses of the construction force are especially isolated in a community that often treats them as outsiders.

Unemployment may actually go up as skilled workers are brought into the area. In Whatcom County, Wyoming, unemployment rose from six percent to nine percent during the construction of an oil refinery. The unemployment in Alaska rose to eleven percent during the construction of the pipeline.

Almost any type of energy development will mean population growth. Sweetwater County, Wyoming, doubled in size in four years during the construction of the Jim Bridger Power Plant. Valdez, Alaska, grew from 1,000 to over 3,000 in less than one year during the construction of that part of the Alaska pipeline. An extreme example is Colstrip, Montana, which grew from 200 in 1970 to 3,000 by 1975 during the construction of two electric generating plants. The National Academy of Sciences has suggested that those areas to be impacted by western coal development be designated as "national sacrifice areas" because of the pressures of population growth and environmental hazards.

The proposed development of nuclear power plants specified that they not be constructed near population centers. James Schlesinger has proposed the construction of more than 230 conventional reactors by the late 1990's. The problems with nuclear reactors are too complex to be discussed here, but the building of these

plants will probably lead to rapid population growth at or near each site. A single nuclear power plant project uses up to 2,500 construction workers at its peak, and it often takes five to ten years to build such a plant.

The operating force of an energy project is significantly smaller than the construction force. For example, a nuclear power plant has an operating force of about 150 workers. Employment drops rapidly after a project is completed, but the population only drops slightly. Economic and social problems result when resources are depleted and construction work dries up. All of these problems are compounded when several projects are developed simultaneously in an area.

Of course all of the impacts of an energy project are not negative. Pennsylvania, West Virginia, and Kentucky may be revitalized by the increasing importance of coal production. Benefits tend to be long-range and regional, however, and there is an immediate need for planning for local population growth. The economic and tax base of an area is often strengthened, but that usually occurs too late to pay for the increased need for public services. It is important to consider the immediate growth impact on an area and provide funding for public services at the start of a project.

POPULATION PRESSURES ON THE MOUNTAIN ENVIRONMENT

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Zero Population Growth, Colorado
Denver, Colorado

> People like living in the mountains: they are moving out of the cities to escape the sterile urban landscape. But in their haste to escape the city, they are creating the same environment they are trying to leave behind.[1]

There is mounting concern for the alpine ecosystem's ability to withstand the onslaught of population growth and remain the pleasurable, "alternate" environment cherished by so many. Mountain terrain is among the most fragile in all nature. Very thin soil and steep slopes that hold neither moisture nor nutrients, short growing seasons and severe weather conditions all contribute to a delicate environment highly susceptible to man's intrusion. The semi-arid Rocky Mountains have thin soils and low ground cover and are subject to strong winds, drastic temperature changes and alternating droughts and heavy rains that render the landscape especially sensitive to human impact. The Sierra-Nevada-Cascade Mountains on the Pacific Coast also have vulnerable vegetation that cannot take much abuse. The Great Basin Mountains west of the Rockies are the most arid of the major North American ranges, and the poorly developed vegetation exposes the soil to harsh external pressures. In the Appalachian Mountains, the dense vegetation is threatened by acid rain runoff from the heavy metal deposits exposed by man's activity.

Yet these environments are exceptionally attractive to people, and increased mobility coupled with increased affluence makes them easily accessible. In addition to the attraction of the mountains themselves, three of the four mountain regions of the U. S. are in the West, which is experiencing more in-migration growth than any other part of the country. In Colorado's Jefferson County, which borders west Denver and extends into the foothills of the Rockies, fifty percent of all in-migration to mountain areas is from out-of-state.

People "use" the mountains in various ways that can be categorized into "non-consumptive" or "consumptive" use. We will examine both categories and discuss the effect of different activities upon the mountain environment.

I. Non-Consumptive Use

Non-consumptive use of the mountains is the taking of basically intangible characteristics from the mountains - such as aesthetic values, tranquility, pleasure, recreation. This is done by tourism, the building of second homes, and recreation. However, non-consumptive use of the mountains requires construction of facilities to enable people to utilize and consume the intangible assets.

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[1] Charles W. Howe, chairman, research team, University of Colorado, Residential Development in the Mountains of Colorado: A Handbook of Problems and Guidelines, (Colorado: United Banks of Colorado, Inc., 1972), p. 4.

A. Transportation systems enable people to move about and reach their destinations.

Construction of transportation systems has a substantial impact on soil erosion and water quality. Bulldozing delicate mountain soils frequently causes soil erosion. The soil is more susceptible to wind erosion; road dust becomes a pollution problem. One effect of soil erosion is eutrophication. Water runoff carries with it substantially more soil nutrients and deposits them into ponds and lakes. Increased nutrients in the lakes together with sunlight cause vegetation to increase. As this vegetation decomposes, it consumes the oxygen in the lake. This is the process of eutrophication. It will eventually lead to what is termed a "dead lake". The fish cannot get their necessary oxygen; very little can live in the lake.

Further development of the mountains is easily facilitated by extensive road systems. Reduced travel time is an inducement to growth. The opening of the Eisenhower Tunnel on Colorado Highway I-70 in 1974 has brought increased development to the western part of the state. By 1990, traffic volume in the Blue River Basin of Summit County, Colorado, is expected to double from its 1970 volume. Even a private area requires a road for access, and this road becomes a belt way of new activity resulting in loss of the original privacy.

Maintenance of mountain roads, due to increased climatic variability and steep grades; costs on the average of 2½ times as much in the mountains as on the flatlands.

Pollution gases take up a larger fraction of the atmosphere at high altitudes where the air is thin than at lower altitudes where the air is more dense. Therefore, the effects of equal weights of a particle pollutant are felt more as altitude increases. Add to this the fact that pollution from auto emissions increases with elevation because more unburned hydrocarbons are emitted at a high altitude, and you have the potential for serious problems.

Mountain temperature inversions can capture pollution emissions and make them more caustic. A build-up of cold air on higher slopes drains to the basin floors and warmer air prevails in the valley's upper atmosphere. An inverted temperature gradient such as this can hold the pollutants for extended periods of time.

B. Residential and second home development is accelerating in the mountains and is often overlooked in the problems it creates.

Like the construction of roads, the building of homes frequently results in heavy soil erosion. Water runoff dumps nutrients into water systems, with eutrophication of lakes becoming a possibility.

Selecting locations for developing a mountain community is a problem in itself.

> Man, as an animal, (competes) with other animals for food, cover, and water. Unfortunately, man's chosen living space is on the valley floor and in the mountain park. Until recently, these land areas were agricultural lands; land uses that modified but did not make the landscape uninhabitable

> for wildlife. Today, these farms and ranches are being bought, subdivided, and sold to the public as residential or seasonal homesites. The landscape is losing its capacity to support wildlife populations and wildlife is forced onto less land and less favorable habitat. Some animals such as elk, sheep, goat, and bear cannot maintain their population size in proximity to human settlements. These animals need protection from land development if they are to survive.[2]

Man is destroying large areas of winter range for deer, elk, and others. For some animals, such as the eagle, the presence of man and their natural timidity have caused reduction in their populations.

The mountain valleys offer the greatest variety of plant and animal species. Valleys are ecological transition zones between water and marsh life and the many different kinds of alpine life forms. Mountain valleys are areas of unusual diversity of both plants and animals. Unfortunately, it is in this same ecotone that man builds his roads and his towns.

An example of man's insensitivity to wildlife's natural habitat is the development at Evergreen Lake, Colorado. The lake was once adjacent to a marsh area supporting wild ducks, other water fowl, and beavers. The marsh was filled in and graded for a parking lot for using Evergreen Lake as a skating rink. The wildlife lost their nesting area and have vanished.

Subdivision design is important in a mountain community. The most widely used types are rectilinear design - straight line planning - and curvilinear design - curved roadways and lots. Curvilinear design creates "spread cities" as we have seen in suburbs. Yet curvilinear design remains the most popular subdivision method and has been incorporated into many county subdivision regulations. Rectilinear design is monotonous, ignores the topography of the land, and opens the area to heavy vehicular traffic. This form of design has been almost eradicated from city suburban development. But in the mountain counties with inadequate county controls and little public awareness, many mountain developers are using rectilinear design. Rectilinear and curvilinear designs ignore unusual ecosystems and assume the land is homogeneous and can all be treated alike.

Cluster design, a third type of subdivision design, allows for grouping of housing units more closely and then the remainder of the land is designated as open space. But it is very easy to cram an excessive number of people into a mountain valley with cluster design.

However, the designation of open space is important in the mountains, and this makes the cluster design more suited to mountain environment. Often mountain subdivision provides only living space or a base camp from which to seek recreation. The result is heavy crowding of the public land for recreation.

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[2] Ibid. p. 9.

Few realize the increase in air pollution from wood burning fireplaces. Vail and Steamboat in Colorado have both had some serious air pollution on winter weekends due to fireplace smoke and temperature inversions.

Water supply becomes a critical issue in the three western, arid mountain regions. Surface stream waters are already appropriated to downstream water rights. This leaves ground water for developing mountain areas. Sufficient water is often not available, adjacent wells begin to adversely affect one another, water rights are sold separately from land rights unbeknown to the purchaser, and the tremendous influx of people may result in mountain areas without water during a drought period.

Flood control projects often are sought by new communities. Flood control projects alter stream flow and disrupt natural ecosystems in mountain valleys. In addition, flood control measures may create an impounded pool larger than the area it protects.

Fire is one very real danger to mountain homes. The majority of development in the Rocky Mountains, for instance, is occurring in the "Transition Zone" between 6,500 feet and 9,000 feet elevation. The forest cover and rugged topography coupled with a drought often create fire hazards in this zone. Another characteristic of this elevation range is high winds that quickly spread a fire. In mountain valleys, up-slope winds usually exist and can spread a fire over large areas. Multi-storied condominiums in dense groupings make firefighting difficult. Mountain home fire insurance is usually very expensive. People with mountain homes must accept that they may lose those homes to fire.

C. Economics of mountain development have some unique characteristics.

Goods and services have seasonal demands. They must be sufficient to handle peak numbers during seasonal vacation use, yet they are supported and managed by a much smaller year-round population. Firefighting is a prime example. Mountain communities have basically maintained voluntary fire departments. But sophisticated fire equipment and the existence of peak seasons of activities require well-trained personnel.

The financing of services - as fire protection, police protection, road maintenance, trash removal, medical facilities, educational facilities, and sewage treatment plants - is oftentimes difficult. Sales taxes from visitors may all go to the state and none to the community. Property taxes from higher mountain values generate some revenue, but often in mountain communities there is no high assessed industrial or commercial development. This puts county governments into competition with each other for more development and therefore more revenues. For other communities desiring to remain intact, there are real economic as well as social implications of unwanted, increased tourism and recreation.

Tax structures are county-wide, not regional. Hence, increased demand for services in the mountains may require increased taxes for the county. People living on the flatland end up paying for mountain development, too.

County planners will often expand services beyond their needs in order

to accommodate anticipated growth. This, in fact, encourages that anticipated growth.

When economic growth depends on a tourist population, resources are diminished which can be especially damaging in mountain areas. Then environmental quality deteriorates, recreation demand decreases, and the businesses of the area suffer. The activities of mountain users eventually destroy the very qualities which first attracted them to the mountains.

Recreation and a tourist economy are very sensitive to national economic conditions. For example, in Jackson Hole, Wyoming, tourism dropped 33% during the oil embargo because of the gasoline shortage.

D. Sewage treatment is a big question in many communities.

If communities meet their state or Environmental Protection Agency (EPA) permit requirements, eighty percent federal funding is available to them for construction of sewage plants. But communities exist on their own for long periods before applying to EPA for sewage treatment facility funds.

In some small mountain towns where the sewage systems have been federally financed, the federal requirements have caused very large sewage lines to be built into uninhabited areas. The presence of these large sewer lines has opened the way to additional growth.

Individual septic tanks are used in small communities or as a result of fragmented growth. Successful septic tank treatment requires the proper soil and a low water table. If soil is too tight, as is often true of high-clay content soils in mountain valleys, it impairs the proper filtering of the sewage. The severe cold of winters retards the essential bacterial action to treat the sewage. Due to the shallow and rocky mountain soils, the effluence will filter into fractured bedrock and enter the water table, wells and streams. On sloped surfaces, up-slope septic tanks have been known to permeate down-slope wells. In one survey in Summit County, Colorado, one out of four wells in mountain communities showed contamination. One community showed sixty percent contamination.

Collective community systems encounter problems due to insufficient land in a valley area for facilities. This is especially true for leaching fields. Ski resorts find self-contained treatment plants may not work, as with septic tanks, since the temperature is too low for needed bacteria action. The result is that many ski areas use storage tanks for sewage and then truck the waste to a plant.

In Vail, Colorado, increased growth has meant increased water consumption and less water in the river for treating the sewage.

Meeting peak treatment needs is another problem. In Grand Lake County, Colorado, with 300 to 400 year-round residents and peak days in the summer of 15,000 tourists, it was found that during those peak days sewage discharge was only partially treated and contained excessive nutrients. The result is excessive nitrate buildup in the lakes, increased vegetation, and then insufficient oxygen for the fish. A similar situation has occurred at Lake Tahoe, Nevada, and required the

installation of an additional water treatment facility.

E. Recreational sites and recreational activities themselves cause stress on the mountain environments.

Campgrounds and wilderness areas are becoming more and more crowded as more and more people are swarming into the back country. The result is both "overpopulation" and "overrecreation" as increased affluence and increased frustration with the city play an important role in mountain tourism. Wildlife is disturbed and retreats to higher land or land otherwise not suitable for its species. Erosion along forest trails from hiking and recreational vehicles is accelerating. Alpine tundra near or above timberline - 10,000 feet to 14,000 feet elevation - is extremely vulnerable to disturbance. At these evaluations, one pass of a motor vehicle or ten days of concentrated walking can create an eroding, impoverished ecosystem that takes from 100 to 500 years to restore itself. And noise pollution from motorbikes, tote-goats, and chain saws is becoming an increased problem. The noise disturbs not only wildlife, but man as well.

Hunting can be classified as mostly recreational. Man's activities have eliminated some natural predators and some wildlife habitats. This results in man taking the place of the predator. But if hunting is not within legal boundaries, man as the predator can affect the species' very existence.

Skiing seems to be a clean and quiet sport, but its impact on the mountains has been incalculable. Whole new towns have been created just to accommodate the skiing industry. While the sport is quiet, the machinery around a ski resort is not quiet, especially snow-making machinery which runs at night. Ski resorts are usually in narrow valleys where air quality is polluted by temperature inversions that hold auto emissions, hydrocarbon emissions from ski-lift machinery, and wood smoke pollutants from a great many fireplaces.

In an environment where it takes hundreds of years to develop an inch of delicate top soil, a poorly maintained ski trail can wash out to a depth of several feet from a heavy rain.

The construction of a ski resort generates the initial impact on the environment. The impact can be somewhat controlled after construction if the ski area desires. When resorts operate beyond their design capacity, then they become destructive. In Summit County, Colorado, ski visitors are increasing at the rate of 19.8% a year. This results in overpopulation of existing ski areas and adds impetus for construction of new areas.

Artificial snow buildup may result in unusually heavy spring runoff bringing washouts, siltation and deterioration of stream quality. Artificial snow-making takes a great deal of water, decreasing its availability for other uses. And the water may return to the stream in an entirely different area and thus disturb stream flow and the ecosystems that border it.

Cross-country skiing, thought by many to be less detrimental to the environment, may be destructive to wildlife. Animals may burn more energy running from humans than they can replace on a winter diet.

The result is sometimes starvation for deer and elk.

One of the biggest problems with ski areas is the widely uneven demand put on sewage treatment. Everyone takes a shower between 4:00 and 6:00 p.m. The ski areas have a substantially difficult time properly handling the water and soap disposal when all the thousands of residents bathe after the tows close and before the night life begins.

II. Consumptive Use

Consumptive use of the mountains involves use of the mountains in other ways aside from human enjoyment and recreation. Consumptive use of the mountains is the use of or removal of some product of the mountain ecosystem for profit. This consumptive use is not a result of population pressures in the mountains, but is a result of population pressures and demands for resources by our entire planet.

> The Rocky Mountain Region has over one-half the coal, one-third of the oil and natural gas, 100% of the uranium, almost 100% of the oil shale and geothermal potential and a large part of the hydroelectric generating capacity, 75% of the copper, 90% of the molybdenum, 60% of the phosphate, and 85% of the potash vital to the energy needs and food production throughout the U. S.[3]

A. Water is one of the resources tapped in the mountains for commerical uses.

Water is impounded in the mountain terrain for use in irrigation, in power generation, and for urban population use. This impounded water then becomes a natural prime recreation attraction, further adding to its commercial use. Population increases the need for water, and water development projects in turn encourage population growth.

Reservoirs can alter ecosystems and affect wildlife habitats. Reservoirs are created by flooding mountain valleys, again destroying ecotones, taking prime agricultural land out of production and taking winter ranges from wildlife. To use Colorado as an example, stream valleys represent only five percent of the total land in the state and are frequently being converted to a watershed of one type or another. Yet 40% of all wildlife in the Rocky Mountains lives in stream valleys, and they are gradually losing their habitat.

Reservoirs disturb the nutrients in stream water by preventing them from flowing dowstream. This reduces the productivity of downstream irrigated land. Concentration of minerals may degrade the water quality of the reservoir itself. And all reservoirs eventually fill with sediment. Increased concentration of minerals and sedimentation both require increased water treatment, which increases the cost of the water.

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[3] Rocky Mountain Environmental Research, Quest for a Future, (Colorado: Institute for Arctic and Alpine Research, 1974).

The water quality of the streams is also affected by water developments projects. By damming the water and reducing stream flow, salinity increases downstream. When the water level is too low to adequately dilute the salt in the water that comes from the natural erosion of shale and mineral springs, the soil irrigated by that water is less productive. Currently, the Environmental Defense Fund is suing the federal government because the Colorado River has become one-sixth as salty as the ocean.

B. The logging industry degrades water quality by increasing soil erosion from road building and skidding operations, and by clear-cutting. This erosion leads to increased sedimentation which damages fresh water fish and increases the cost of water treatment.

> Studies have indicated that suspended sediment concentrations in a stream immediately downstream from an improperly logged area were 7,000 times the natural sediment content.[4]

The organic debris eroding from a logging site leads to increased nitrate release into the waters and eventual eutrophication.

When logging has removed trees along streams, it exposes the stream to increased sunlight. Water temperature can increase by as much as 16° F., killing fish and fish eggs.

The abundance of roads created for logging have a secondary effect on the mountains. The road network means easy access to the area and increased recreation follows.

C. Grazing of livestock is not to be underestimated. Put in its historical perspective, grazing has completely changed the mountain ecosystem. Grazing by the large animal herds of the 1800's brought about complete changes in vegetation patterns in many areas. The impact from current grazing occurs when land is overgrazed, such as too many livestock in an area or grazing extended for too long of a time period in an area. Using pasture land during the improper season is also harmful to the ecosystem. Herders must be very knowledgeable of ecosystems and know when grazing will trample in new seeds or when it will pack the soil making it difficult for grass to grow. The most concern must be given to grazing on tundra because it is the most fragile of mountain ecosystems and requires many years to replenish itself.

D. Hunting also comes under the category of a commercial industry, although this involves a smaller amount of the wildlife hunted than does recreational hunting. Commercial hunting is the hunting of legal catch for its pelts, such as coyotes, trapping for the same reasons, commercial fishing, and some poaching. The problems with commercial hunting are the same as with hunting for recreation. Regulations have been established to protect the wildlife. If hunting is done outside of those

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[4] Geise, J. William, Jr., "Mountain Development: Effects on Water and Air Resources," presented at Environmental '72 Conference, Denver, Colorado, p. 3.

regulations, it can be disastrous to a species.

E. Mineral and oil exploration can be one of the most instantly degrading forces to the mountain environment.

If the land is not reclaimed, the impact to the land is on the s[illegible] usually associated with natural disasters. In the Appalachian Mountains, strip mining often results in removing the entire top of a mountain. This strip mining exposes layers of rock and soil which contain heavy concentrations of iron sulfide. Rain water "runs red" from those exposed areas. "Dead streams" result, vegetation is markedly retarded, and people and animals are sickened.

Many times with coal, oil and gas exploration, bulldozing for roads and pipelines is done in excess of the need and without regard for water drainage. This results in serious erosion and sedimentation problems. Estimates of destruction in mining areas indicate that for every mile of road or pipeline, 2.4 to 5 acres of vegetation are destroyed.

Mining frequently results in saline water supplies. One reason is that the mine tailings are highly acidic and increase the salinity of the water. The second reason is that large amounts of good quality water are necessary for mining, especially with oil shale. This reduces the water level below that needed to sufficiently dilute the salt content of the streams. Again, land irrigated by this water is less productive.

Oil shale development is still uncertain. There was no mention of oil shale in President's Carter's energy proposals. However, according to Dudley Faver, Rocky Mountain Regional Administrator for the Federal Energy Administration, the industry would be entitled to market any oil produced at world prices. For this reason, oil shale development will be discussed as still a possibility.

Oil shale is a heavy polluting industry. The process of deriving oil from shale is to "cook" the rock to 900° F. This process releases abundant dust and chemical pollutants into the air. The "spent shale," the mine tailings of the oil shale industry, is a black talcum-like powder that is very dusty, very unsightly, and destined to fill mountain valleys near oil shale plants.

Oil shale is a very energy-inefficient source of energy. It takes more energy to produce oil from shale than the energy the oil can produce! If oil shale is developed, coal will have to be developed, too, to supply the necessary electrical power. And mining of oil shale will take great amounts of water. The current situation in Colorado is one where oil companies have purchased the water rights to assure the possibility of future development. They are leasing the water to farmers in the interim. If and when the oil companies need the water, they will take it back from the farmers.

The real effect of oil shale development may be the accelerating effect of everything else so far discussed. The Department of the Interior estimates oil shale development would bring 120,000 to 200,000 new people to Colorado. In addition, there is probable

reason to predict other industry would move from the East to the West to be near the energy sources. Maybe the question should not be "how" oil shale is to be developed, as most of the present debate concerns itself, but instead "if" oil shale should be developed.

What Can Be Done

In some instances, attempts are being made to control the impact of man on the mountain ecosystem. These are some of the steps being tried:

1. Educating the public to the implications of mountain development.
2. Monitoring population growth estimates by community and region.
3. Developing land use legislation to establish guidelines for land, air and water quality.
4. Requiring planning to precede development.
5. Requiring review of development plans by appropriate technical committees.
6. Establishing a mineral severance tax to reclaim the environment.
7. Monitoring activity to assure regulations are being met.
8. Assessing the impact of land activity to evaluate and adjust as necessary.

Land use regulation is still a "developing" concept in our society - no pun intended. How to direct land use control and the results of the effort are yet to be judged. One thing should be obvious, however: to do nothing is not the answer.

BIBLIOGRAPHY

Colorado Citizens for Clean Air, Denver, How Long Will it Remain Visible, Colorado, 1975.

Colorado Environmental Commission, Colorado: Options for the Future, final report, Colorado, March 1972.

Colorado Investor, The, Land Use in Colorado: A Special Report, Colorado, Mountain Empire Publishing, Inc., May 1972.

Denver Post, The, April 21, 1977, Page 1, Column 6.

Geise, J. William, Jr. "Mountain Development: Effects on Water and Air Resources," paper presented at Environmental '72 Conference, Colorado, March 1972.

Howe, Charles W., Chairman, Research Team, University of Colorado, Residential Development in the Mountains of Colorado: A Handbook of Problems and Guidelines, Colorado, 1972.

Ives, Jack D., and Stites, Ann, Impact on Human Activities on Mountain and Tundra Ecosystems, Boulder Workshop Program on Man and the Biosphere, Instaar Special Publication, Colorado, May 1975.

Jerome, John, "Skiing and the Environment," EPA Journal, February 1977, Vol. 3, No. 2.

Losinski, Elizabeth A., Student Intern, Mountain Growth and Development: Jefferson County, Colorado, Western Interstate Commission on Higher Education, October 1971.

Rocky Mountain Environmental Research, Quest for a Future, Colorado, draft final reports, Institute of Arctic and Alpine Research, February 1974.

Ulman, Wilbert J., "The Summit County Experience," Mountain Recreational Communities and Land Use, Land Use Commission, Colorado, 1974.

U. S. Environmental Protection Agency, Region VIII, Aspen/Snowmass - 201 Wastewater Facilities Plan, draft environmental impact statement, Colorado, Weiner & Associates, 1976.

INTERVIEWS

Collins, Kay, Conservation Library, Denver Public Library, Denver, Colorado.
Geise, J. William, Jr., Environmental Protection Agency, Denver, Colorado.
Johnson, Carolyn, Mining Workshop, Colorado Open Space Council, Denver, Colorado.
Taylor, Gene, Environmental Protection Agency, Denver, Colorado.
Wilson, Wes, Environmental Protection Agency, Denver, Colorado.

POPULATION EDUCATION: CASE STUDIES ON THE IMPLEMENTATION PROCESS IN SECONDARY SCHOOLS

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This concerns the implementation of population education in selected secondary schools. It is an exploration of the circumstances and events that occur when individual teachers recognize the need for population education and attempt to place population topics within traditional curriculum and schedules.

METHODS USED

Case Study Approach

The case study approach was used to document implementation in subject areas as diverse as junior and senior high social studies, grammar and composition and in public and private, suburban and inner city, vocational and college preparatory schools. The process of implementation was studied with the teacher serving as co-investigator. Each teacher recorded various approaches used to introduce population related materials into the classroom. They also recorded how they coped with problems and assets which they encountered. This account is intended as a guide to the larger field of possible environments. With this resource one can sort out and project the most viable recommendations for the implementation of population education.

Participants

Case participants were selected from groups of teachers who had taken a course on population education in the spring and summer of 1975. The course offered (1) basic population dynamics including the history of population growth, the nature of populations, factors influencing population (birth rate, death rate, migration, distribution, and density), and issues related to population such as food, energy, and values; (2) the content, organization, and implementation of population education; and (3) teaching strategies and materials related to population issues. Those enrolled in the course were primarily teachers in the K-adult levels from thirteen different cities within a seventy-mile radius from the University of Michigan campuses in Dearborn and Detroit.

The final group of five were those able and willing to implement population education in the fall term. They represented different disciplines and extremely diverse personal backgrounds and school environments. Mr. Parkington (code names are used throughout this text) taught social studies in a junior high school located in a suburban community. The junior high was part of the elementary building and the atmosphere and the curriculum were not as distinctively "junior high" as they might have been. However, the total school atmosphere was quite different from the senior high schools. There were two senior high English teachers. Mrs. Williams taught in an inner city school; Mr. Smythe in a wealthy suburb. The settings, the course materials, the personalities and teaching styles of the two contrasted sharply with each other and with the other three participants. The fourth teacher, Mrs. Newman, taught sociology and social studies in a city-wide vocational school located in the center of the city. Again the type of school;

location, student body, and subject matter were quite distinct from any of the other teachers. The fifth teacher, Mr. Christabal, taught Spanish in a private Catholic school. There were few similarities between his situation and any of the others.

Data Sources

Four data sources were used to document the implementation process: a pre-course survey, written and telephone logs, school site visits, and a final interview. The emphasis was on getting as complete and coherent a narrative of implementation as possible. These data sources, their purpose and kind of information gained from each are summarized in Table 1.

TABLE 1

DATA SOURCES, PURPOSE, AND INFORMATION GAINED

Data Source and Purpose	Kinds of Information Gained
Pre-course survey to provide background information	personal data description of the school current activities in population education identification of individuals who influence change barriers to teaching population education
Logs, written and telephone to get a detailed account of implementation	general teaching schedule kinds of course(s) used for implementation methods used in teaching student response other audiences contacted communication processes helps to implementation hindrances to implementation availability of resources use or non-use of resources kinds of materials exchanged relationships with administration details on curriculum change process interaction with department head and co-teachers
School site visit to supplement and give a contextual basis for the implementation account	spirit and nature of the school environment community setting operating procedures of the school curriculum offerings kind and quality of library references on population classroom teaching styles responses of principal and teacher toward curriculum change and population issues

Final interview	helpful factors for implementation
	hindrances for implementation
to summarize	statement of future plans

FACTORS INFLUENCING IMPLEMENTATION

Situational Contrasts

The case study was used as a means to describe and assess the influence of various factors on the implementation process. First, the teachers had to cope with various background elements they met in their efforts to introduce population education. For purposes of this study these factual dissimilarities will be called "situational contrasts." Situational contrasts include background factors such as the experience, education, and personal competence of the teacher. They also include the subject areas, grade level, and courses used for implementation. Finally, situational contrasts refer to the kinds of schools, socio-economic levels, and diversity of student bodies and parents.

The more general background elements for each of the f e cases is set forth in Table 2.

TABLE 2

SITUATIONAL CONTRASTS: OVERVIEW

School Name	Clinton	Incity	Vera Cruz	Vocational	Greenvale
Kind	Public Jr. High	Public Sr. High 10-12	Private Sr. High 9-12	Pub. Voc. High 10-12	Public Sr. High 10-12
Finances	District	District	Tuition, donations	Title I funds	District
Location	Suburb	Innercity	Suburban	Central city	Wealthy suburb
Teacher	Mr. Parkington	Mrs. Wms.	Mr. Christabal	Miss Newman	Mr. Smythe
Education	Ph.D. candidate	M.A.	M.A.	B.S.	B.S.
Experience	8 years	6 years	4 years	3 years	3 years
Teaching area Expected	Soc.Studies	English	Spanish	Soc.Studies (Urban Stud.)	Soc.Studies
Actual	Soc.Studies	English	Spanish & business	Soc.Studies	English
Course(s) for implementation	American and World History	Grammar	Adult business	Sociology	Composition
Student level	9th graders	10-12th graders	adults	11-12th graders	12th graders
Most significant influence on implementation:					
help	experience teaching, expected course	experience teaching expected course	experience		
hindrance			new course	inexperience n w course	inexperience new course

The kind of school, the experience and education of the teacher, the courses, and grade level taught are included. The background component which seemed to influence implementation to the greatest extent is included at the bottom of the table. These will be discussed in greater detail later.

Dimensions: Administrative, Departmental and Interdepartmental Resources

Second, the teachers were faced with an assortment of influences which affected their efforts to implement population education. These were areas of special concern to the teachers before and during the time of implementation. The final collection of actual and potential influences were gleaned through pre-course surveys administered to all potential case study participants. The major influences which these and other teachers would encounter in their efforts to use population topics in classroom teaching were categorized as "resource, administrative, departmental and interdepartmental." The administrative dimension refers to any influence that comes from one with a higher level of authority than the classroom teacher. This dimension is further divided into those influences which are general in nature and those which deal with formal process of curriculum change. The general category included characteristics and behavior of the principal and department heads. It also refers to issues such as fear of controversy, cost of materials, and personal objections to the content or method of population education. The category, formal process of curriculum change, relates to all the mechanisms by which course content is modified or new materials introduced into the school system. This includes the work of curriculum committees, processing of formal requests, and the time in which change is made.

RESULTS

Kinds of Implementation

The two primary categories of implementation which occurred across the cases were the classroom kind and the communications kind. Tables 3 and 4 on the following pages present some of the ways population materials were used.

The specific classroom activities related to population topics are summarized in Table 3. Each teacher, school, and subject area is listed. The various forms of classroom learning and the kinds of audio-visuals used are indicated for each of the participants. For example, in Table 3 Parkington at Clinton used lecture, reports, graphing and other methods of teaching. He also used posters and films. Newman used lecture, discussion and graphing but no audio-visuals. As represented in Table 4, implementation by communications is presented for each of the teachers. This second table shows that Christabal dealt with students outside his school and with family and friends. The table indicates that Smythe interacted with his principal but not with the department head or librarian. Finally both tables give an overall rank in implementation to each of the teachers. This rank is based on the measure the individual teacher implemented compared with the other participants.

One can see implementation varied in kind and quality across the cases. Some of the teachers emphasized classroom implementation; others chose to implement among their peers. There were numerous influences on that process and those influences will be discussed next.

TABLE 3

SUMMARY OF OCCURRENCE OF IMPLEMENTATION: . CLASSROOM AND AUDIO VISUAL

Teacher School	Parkington Clinton JH	Williams Incity SH	Christabal Vera Cruz	Newman Vocational	Smythe Greenvale SH
Subject	American & World History	English Grammar	Adult Business Education	Sociology	English Composition
Classroom Learning					
lecture	x	x	x	x	
discussion	x	x	x	x	
worksheets	x	x	x		x
debate/interviews	x	x			
values clarification		x			
reports	x				
use of newspaper articles	x				
group projects	x				
cemetery field trip	x				x
viewing films	x				
graphing	x			x	
writing stories		x			x
exams	x	x	x		
Audio Visual Use					
films	x				
transparencies	x				
charts	x	x	x		x
posters	x	x	x		
Classroom Implementation Rank	1 (highest)	2	3	4	5

TABLE 4

SUMMARY OF OCCURRENCE OF IMPLEMENTATION: COMMUNICATIONS

Teacher School	Parkington Clinton JH	Williams Incity SH	Christabal Vera Cruz	Newman Vocational	Smythe Greenvale SH
Subject	American & World History	English Grammar	Adult Business Education	Sociology	English Composition
Communications					
students					
inside the school	x	x		x	x
outside the school			x		
co-teachers					
within the department	x	x	x	x	x
outside the department	x	x	x	x	x
teachers outside the school		x	x	x	
department head		x	x	x	
principal	x		x	x	x
union representative				x	
librarian	x			x	
friends	x		x	x	
family	x	x	x	x	x
other	x			x	
Rank for Implementation by Communication	2	4	3	1 (highest)	5

Influence of the Situational Contrasts and the Three Major Dimensions

As described earlier the resource, administrative, and departmental dimensions represent clusters of factors which influence the teacher's efforts to implement population education. These were areas of special concern to the teachers before and during the time of implementation. The dimensions are ways of categorizing the major influences these and other teachers would encounter in their efforts to use population topics in classroom teaching.

Table 5 on the following page summarizes the most important situational contrasts and outlines the role and effect on implementation behavior of each dimension in the implementation process.

The table is a comparative summary of implementation and influencing factors. The relative importance of the situational contrasts and the dimensions is presented. Just as the teachers were rated on implementation (Tables 3 and 4) the overall influence of both the situational contrasts and the three dimensions were also given a rating. The rating was positive (+) if the situational contrast or dimension was helpful to the teacher's efforts to implement and negative (-) if the influence was a hindrance. Finally, a comparative rank on implementation is offered. (See bottom section of Table 5.)

This section will discuss in more detail the factors which influence implementation behavior and the relative importance of each of the influences. The four areas (1) situational contrasts, (2) resources, (3) administrative, and (4) departmental and interdepartmental are discussed separately. While all these are operational in the case of the five teachers, some are more important than others.

Situational Contrasts

The teachers all had the same background course and a prepared unit with classroom activities, and it was expected that each would be able to implement in his own situation. Each of the teachers also had a special interest in population education and was motivated to teach it. Nevertheless; as shown in Table 2, the teachers had to vary their implementation to correspond to many differences in settings, subject matter, and student body characteristics. The implementation outcome was different in each case and not as extensive as anticipated.

Newman did no classroom implementation; Smythe did practically none. Christabal did very little. Only Williams performed creatively at the classroom level, and Parkington implemented a great deal. When the five teachers are given a classroom score, Parkington at Clinton Junior High would be the highest followed by Williams, Christabal, and Newman. Smythe would be the lowest.

Those who implemented in the classroom were actually the most experienced teachers who were teaching the course they anticipated teaching (Parkington at Clinton and Williams at Incity). They were able to use their prepared materials. It was surprising that Williams at Incity, who had no materials in her subject area other than those she designed and later supplemented, implemented a great deal. Newman, on the other hand, had plenty of materials but did not implement at all in the classroom.

In general it could be concluded that length of experience and teaching the expected course when the term actually began were the most important aspects of the background which influenced implementation. The more experienced teacher with the course he expected to teach was able to implement to the highest degree. The role

TABLE 5

COMPARATIVE SUMMARY OF INFLUENCES ON IMPLEMENTATION: MOST SIGNIFICANT HELP (+) OR HINDRANCE (-)

Teacher School	Parkington Clinton JH	Williams Incity SH	Christobal Vera Cruz	Newman Vocational	Smythe Greenvale SH
Situation Contrasts experienced teaching expected course	+ yes + yes	+ yes + yes	+ yes - no	- no - no	- no - no
Dimensions Resource having material in subject area	+ definitely	- none	+ adequate	+ abundant	- none
ability to adapt available resources	+ definitely	+ yes, created her own	- did not adapt	- no	- unable to adapt
Administrative	+ school autonomy + operating within building	+ distance from authorities + being isolated	+ school decentralization + no administrative pressure	+ knowing power locus + operating at department level	- school politics -under community pressures
Departmental & Interdepartmental status among peers places to meet	+ yes + yes	+ isolated	+ yes + yes	+ yes + yes	+ unknown - unused
Comparative Rank on Implementation:					
Classroom	1 (best implementer)	2	3	5	4
Communications	2	4	3	1 (best implementer)	5

of the teacher relative to the mixture of background elements made the difference. The kind of school, student body, or subject area made little difference in the actual implementation.

Resources

In general it appears that availability of resources did make a difference in the implementation process. The teacher who had ready-to-use materials implemented. Those teachers who had no prepared materials for the subject area they were teaching found it difficult if not impossible to include population-related ideas in their regular teaching. This was true even though all the teachers had some basic learning activities from the summer course. It required a particular kind of skill and level of experience for the teacher to extensively adapt the new materials into a course during the time the course was in session. None of the case participants were able to accomplish this in any measure.

Administrative

It could be concluded that the administrative dimension is usually perceived as a potential obstacle for the implementation of population education. However, in four of the five cases, the teachers functioned quite independently and at the same time were very knowledgeable about their situation. They were able to meet the constraints imposed by the principal and department head, or by the requirements for curriculum change. It is not at all clear what the results might be for longer term implementation or implementation done on a broader scale. But in this study the effect of the administrative dimension on classroom implementation was not significant.

Departmental and Interdepartmental

Departmental and interdepartmental factors had relatively little influence on implementation. Except for the fact that the teachers exchanged informally on population education, it would seem that many potential opportunities for implementation were wasted. Only in the case of Christabal at Vera Cruz was the departmental meeting a means of sharing in the formal sense.

Three of the teachers (Parkington, Newman, Christabal) enjoyed considerable status among their peers and frequented meeting areas (Table 5). For the most part, all the teachers were positively supported by their departments. Materials were shared with various individuals in the school and beyond it. Only the two English teachers had less exchange, possibly because of their subject matters.

Even with the exchanges that took place, the participants did not ask anything of their co-teachers. Although the teachers were positively supported, no one reported that colleagues did anything more than communicate on the issue. It seems that since the five teachers in the study were just beginning with population education, they undoubtedly needed more self-assurance and teaching materials before they could share extensively.

Influences on Implementation: Conclusion

The length of teaching experience and teaching the expected course were the most significant influences among the many situational contrasts present in each case. Of the three dimensions, having teaching materials ready to use for a given subject area was critical to implementation. Neither the administrative nor departmental dimensions were as important to the teachers as

experience, teaching the proposed course, or having resource materials. Nevertheless, the teacher in the last analysis could exercise control over his individual situation, and the relative importance of any dimension depended on the response of the teacher. The measure in which the teacher implemented rested to a large degree on his capacity to deal with the various influencing factors.

CONCLUSIONS

What conclusions can be drawn from the analysis of the implementation process and the influencing factors? What recommendations are warranted for the implementation of population education in other situations and at broader levels?

First, the conclusions center on two main issues: (1) the role of the individual teacher in implementing population education, and (2) the importance of "ease of fit" as a basis for the quality and level of implementation that occurred. "Ease of fit" means that the easier the materials went into existing schedules and curriculum patterns, the better they supplemented the teacher's need, the more implementation took place. The recommendations suggested here focus on the infusion approach as the most important strategy for implementing population education.

An approach to implementation based on the role of the teacher and ease of fit is one way to meet the three constraints of time, teacher background, and existing curriculum structures. Considering the experience of these cases such a strategy would allow effective implementation to occur with greatest likelihood.

ROLE OF THE INDIVIDUAL TEACHER

Importance of the Teacher

The amount and quality of implementation depended on each teacher. Implementation was enhanced by a supportive school environment. However, no matter what the environment, the individual teacher was a vital factor in the implementation process. Population topics are certainly not required in the secondary curriculum. In fact, population education is probably not understood in educational circles. And so at this time it is the individual teacher's perception of the importance and need for population education which determines whether or not it will be implemented. Gustavus and Huether (1975, p. 205) support this by showing that seventy-one percent of the teachers they surveyed began using population education because of a concern about population. Only four percent began because they were asked by officials. It is the teacher's willingness and interest which placed population education in classrooms. Fundamentally the same was true for the participants in this study. It was the teacher who adapted to schedule changes, taught population education in the classroom, or chose alternative forms of implementation.

Curriculum Change and the Teacher

From these five cases one can conclude that curriculum change is essentially the responsibility of the individual teacher. The formal process of curriculum change was relatively unimportant in the five schools studied. The teacher's role in curriculum change was founded on a high degree of discretionary control on the part of the teacher (Pincus, 1974). The whole process might be different in places where curriculum is highly centralized, for example, in foreign countries.

In the cases studied here, the teachers believed population education was relevant, and that teachers could have a hand in the planning. They were allowed to initiate new materials or courses in their own classrooms and could infuse population education issues. More importantly, they were very independent in their own classrooms and could teach population topics. The teachers planned their units and some executed it. This freedom created more effective implementation. There were no administrative demands to hinder the process.

It can also be said that on administrative issues the teachers functioned at a considerable distance from authority. The teachers seemed to have a practical sense of where the power for change rested in their schools. They recognized that the locus of power was at the teacher level, at the department level, or at the principal level. Generally the teachers implemented efficiently with whatever structure was present. Most of the teachers had good personal strategies for the level of implementation intended during the study.

Communication and the Teacher

The role of the teacher willing to implement population education was affected in some measure by status in the department. Implementation does not stop at the classroom door and the teachers who were closest to their colleagues experienced support for implementing population education. Although peer interaction was not a strong influence, the teacher's ability to relate with others helped with implementation at the communication level. This study showed that teachers did not require formal mechanisms for communication of population materials. Contacts tended to be casual and in some instances widespread.

In brief, the importance of the teacher's influence on the implementation of population education is witnessed by (1) the teacher's ability to adapt and cope with the background elements of the teaching environment; (2) the teacher's ability to implement at the classroom level apart from any administrative barriers; and (3) the teacher's ability to implement by communications with others.

Ease of Fit

The most pervasive factor that seemed to influence the efforts of teachers in implementing population education was "ease of fit." Ease of fit means that the more readily materials, activities, and opportunities for population education could be reconciled with existing time and schedule constraints, with teacher background and needs, and with established curriculum patterns, the greater the amount and kind of implementation that was possible. Why this conclusion is justified will be presented from the perspective of the constraint which the teachers designated as "time." It will also be presented in light of the teacher's background and in terms of the established structures.

The Time Constraint

About fifty percent of the population education teachers sampled by Gustavus and Huether (1975) list time as their most important problem. Availability of materials ranked next. In the present study this problem was expressed most often in terms of having enough time to prepare materials.

Although "time" was labeled by the teachers as an obstacle to fitting in population education, it is quite likely that this response is also a legitimate answer for other realities. For example, time may well be an excuse for lack of skill or inventiveness in introducing new content. It may be used as an explanation for inadequate knowledge or motivation. "Time" may also be an acceptable explanation for the real problems of expanding current textbook topics and creating new materials. It is very likely that the teachers have no formal training and no in-service help on how to adapt curriculum to meet changing needs. Many teachers might be stunted in their ability to include more relevant teaching materials and learning experiences in their everyday teaching. The ease with which population education is introduced does depend on time and schedule constraints, but "time" should not be completely isolated from other unexpressed problems.

Furthermore, if materials are going to be implemented they must be inserted easily into a class and consequently be the kind of teaching exercise that fits the instructional period. Immediate classroom preparation for the teacher must also be kept at a minimum. The high school teacher usually has a minimum of two course preparations, usually three, and teaches five periods five days a week. There is little time to develop new materials on new subject matter. The more easily things can be fitted into this constraint, the more likely they can be used.

In addition, the teacher is probably the only person in the school with any formal education on the issue and so there is little in-service help from colleagues. Although case participants expressed a need for professional exchange, time for communication was also minimal. Formal structures for communication were not visible and the informal, casual approach was used. Materials for this kind of exchange must be of such a form that they can be quickly and conveniently communicated.

The Constraint of Teacher Preparation

Since most teachers have acquired their population education training on the job and during summer school, self-contained material with built-in teacher information would in some measure help to offset weakness in background knowledge. In fact, it was difficult for the teachers to design a unit after just one course. Gustavus and Huether (1975, p. 207) report this same conclusion from their survey. A training institute did not provide enough in the way of designing complete courses. This was evidenced in the five cases discussed here. After learning about population dynamics, doing population activities, and planning a unit to fit a special course, three of the teacher experienced changes so that they were not able to adapt their materials or make substitutions. The teachers were not experienced in designing their own materials. They needed ready-to-use materials that matched their curriculum or materials that were flexible enough to fit in a range of courses. This need is especially apparent for beginning teachers. Having individual learning activities would make the teacher more comfortable with placing population topics into the classroom.

The Constraint of Existing Structures

Materials that fit easily into prepared, traditional curricula maximize existing situations. Sequential programs in other disciplines already exist and the infusion approach makes new materials an integral part of existing course sequences. Inserting population materials into existing courses provides the necessary flexibility for meeting changing programs, enrollments and subject area. Almost all the teachers experienced unanticipated change of teacher assignment which upset

plans made in the summer for population education. The premise that implementation of population education should be based on "ease of fit" is again applicable.

This is supported by Thorne (1975) who described the ten-year effort to get population education formalized in Baltimore schools. He said:

> Another major lesson learned about these experimental units related to the willingness of teachers to use them before they were formally required as an official part of the curriculum. Only those units that could be used easily in already existing curricula or courses were requested. New teaching materials will get general use only if they satisfy a need felt by teachers for materials usable in courses and subjects which they are already required to teach. (p. 262)

This is also the kind of approach that is executed without recourse to higher levels of authority. Short-term materials can be easily changed. Complete changes in structure are not required. Expecting population education to be a part of widespread curriculum change is just not utilitarian. Limiting population education to smaller units of implementation is more realistic and feasible.

The Small Unit for Implementation

These small units, the individual classroom or a single department in which the individual teacher implemented, have been the focus of this study. The five teachers were able to deal with population in a situation limited to the classroom or department. Since population education is by no means required in secondary schools, has no priority with educational leaders, and has not made any significant impact on the educational system at large, the individual teacher becomes the primary unit for its acceptance. Teachers have considerable opportunity and responsibility to implement directly with students at the classroom level. They can and have decided to include the topic.

Although infusion of materials, new units and complete courses have been described as approaches toward implementation (Lane and Wileman, 1974; Massialas, 1972; Population Reference Bureau, 1970) it seems that most of the leadership involved with population education is reluctant to endorse a particular approach. Only Viederman and Wayland have consistently defined population education in terms of planned, integrated, and sequential programs (Viederman, 1973; Viederman and Wayland, 1973). Given all the situational factors and dimensions that influence the implementation process, the planned large scale program may not be a satisfactory approach to implementation at this time. It is simply unrealistic to plan for the inclusion of population education in terms of substantial curriculum revision. And yet, since relatively few innovations persist if they do not become generally accepted, it is important that an effort be made to introduce population education in as many settings as possible (Wayland, 1972, p. 16).

When all is said and done what is needed is a strategy which (1) supports and enhances the position of the teacher in the classroom setting, and (2) recognizes ease of fit as a necessary component for implementation. The infusion strategy meets these two requirements.

The Infusion Strategy

The infusion strategy means planning to put population topics and learning experience into standard classroom curriculum in tangible, immediate steps. The key feature of this approach is that the emphasis should be on population rather than on other subjects. Population topics should be clearly visible.

This approach does not use the detailed unit or population course as its basis. Rather, infusing population topics means they are introduced possibly on a daily or weekly basis over a longer period of time. They are intended to complement and make the existing curriculum more relevant. Nevertheless, this approach is more than accidental awareness. It is an intentional effort to place population education into curricula on an on-going basis.

The infusion approach has been vaguely discussed by population educators. For the most part it has been ignored. The underlying hope seems to be that population education will be created by population programs of wide significance--full scale curriculum change, mini-courses and in-depth teacher training programs. The primary recommendations developed from this study do not agree with that stance. Population educators are not yet important contributors to educational systems. The field is developing but curriculum changes related to population have not been significant. At this time in the history and development of population education, the greatest emphasis should be on the infusion approach.

Advantages of the Infusion Strategy

The infusion approach has a number of advantages. Above all it allows for the uncertainty of not being able to offer a whole unit or population course and gives surety that something will be taught. The approach takes advantage of existing curriculum requirements without creating a new structure. It is conceptually less difficult to design and plan for placing selected topics into classroom teaching. It would be more difficult to do a full curriculum sequence on population themes. Besides permitting population education to become an integral part of standard curricula, this approach employs existing resources and structures for population-related learning experiences.

Second the infusion strategy offsets insufficient teacher background and training in population. With short-term, one-concept lessons the teacher can include basic population information without being an expert in the entire field. This approach supports the teacher because classroom preparation can also be kept at a minimum. Implementing population topics on an on-going basis emphasizes the teacher's authority over classroom topics and keeps the responsibility for teaching population at the lowest level.

In addition, learning materials in the form of easy-to-use, single concept activities are ideal for sharing with other teachers in brief periods of time. This is very important since interdepartmental communication is known to be minimal in the schools. Colleagues would be more receptive to the approach described here.

Finally, population education that is taught by the infusion approach does not require a totally supportive school environment. Since teaching is done mostly within the classroom unit, departmental, administrative, and community factors need not to be involved. Population lessons can be done at the classroom level without appeal to higher authorities. There is more flexibility to meet schedule and subject area changes.

The infusion strategy does not exclude the possibility of fuller treatments, detailed units, and curriculum sequences. Rather it provides an avenue for placing population education into classrooms at a time when the curriculum is already crowded, when population education is not an educational priority, and when systems are so complex that even small changes take a long time to execute.

RECOMMENDATIONS

Rationale for Recommendations

Findings from this study on the implementation process cannot be generalized in any quantitative sense. Qualitatively, these cases have given a kind of imagery on the micro-level which is significant for defining and dealing with the implementation process on broader levels.

The findings of this study indicate the importance of the role of the individual teacher and the significance of the "ease to fit" factor for implementation. In light of this fact, the infusion strategy of implementation is recommended as the method most conducive to widespread use of population topics in curriculum in secondary schools in the United States. Although the particular mix of forces and their relative strength will probably differ from situation to situation, the infusion strategy allows for variation.

Thus, the recommendations listed here are a practical clarification of this approach. The recommendations are not intended to be all-inclusive. They are potential solutions to some of the problems of implementation. They are meant to be practical and immediately functional. They are short term in the sense that as the field of population education expands and becomes more defined, other alternatives will undoubtedly be more suitable for the emergent needs. For now, the following recommendations are considered imperative.

Teacher Training

> Leadership in the field of population education should endorse teacher training efforts which focus on the infusion strategy at the classroom level.

Courses for teachers on the pre-service and in-service levels should define and then focus on minimal understanding of population dynamics. This basic plan should be supplemented by the design of materials that match textbooks and teaching methods in common use by teachers represented in the course. Leadership should include follow-up studies on the implementation process as a means of vitalizing the teachers and also as a way of contributing to the success of population education on an on-going basis.

One viable way to accomplish this would be use a self-instructional course, possibly one done by correspondence. This course would be available to secondary teachers, environmentalists and other concerned citizens. Correspondents would complete the course and then, as one of the course requirements, be asked to enroll a colleague or friend.

A central coordinator or distributor in an area or part of a state would maintain contacts with those enrolled. A university, population center, or publishing agent could conceivably keep the course spreading. One option would be to have the course approved for university credit on a state-wide basis. Whatever the

mechanisms which might develop, the emphasis should always be on the teacher-to-teacher contact.

The course would contain basic social demography in the form of readings and learning experiences. The learning activities would be open-ended enough so that the local situation could be frequently taken into account. The course content would include classroom activities -- materials that the teacher would first experience and then inculcate into his own school program.

The content of the course and the network established would provide the substance on which evaluations could be made. With this framework (1) the course itself could be improved; (2) implementation could be studied; (3) diffusion recorded; and (4) recommendations made for institutionalizing population education in schools. Overall, this recommendation provides the individual teacher with more training and with some basic teaching resources. Such a course would be a practical means of encouraging the infusion of population materials into classrooms and schools and would offer a built-in method of dissemination.

Needed Materials

> Population educators should emphasize the development of learning activities that can be easily integrated into existing course content or which can be used as independent lessons.

If the infusion strategy is applied in secondary schools, the most immediate need will be for materials that can be used for the implementation of population education. From this study it was apparent that ready-to-use teaching materials with built-in knowledge for the teacher were quite important. Materials need to be adjustable to a wide range of subject matter and teaching methods. They should be self-contained or be able to be used alone in a specific course sequence. Lessons should have considerable local emphasis but also a national and world perspective.

Frequent changes of schedules suggest that teachers should expand on existing topics in their established curriculum rather than attempt to inaugurate new courses. In fact, teachers should be encouraged to focus on individual population learning experiences rather than on full-fledged units or sequences.

Exercises and learning activities should have low energy and time requirements for the teacher. Materials will need to be duplicated easily and undoubtedly at low cost.

One potential way of meeting the need of teachers for learning activities is to depend on the teachers to supply the materials. Instead of investing energy and funds to disseminate curriculum materials from administrative levels, a system could be established to get creative ideas from in-service teachers. Financial incentives could be offered for lesson plans, worksheets and the like originating from grass roots teachers of population education. In this way variations in grade levels would be addressed also by those nearest the student.

A local or regional group of teachers with whatever resource persons they see as necessary could evaluate the inputs and be responsible for quality control. Dissemination of materials would be done by request and restricted to the local or regional level.

Again, teaching resources would be the ready-to-use kind with very little

modification needed at the time of implementation. Special emphasis could be placed on topics and methods for language arts classes. A survey of existing resources in science fiction, the classics, and modern writings would help teachers find ways to include population themes in their ordinary teaching.

Personal Strategy for Implementation

> Teachers of population education should develop an individualized strategy for implementing population education in their local settings.

Given motivation and some personal or formal training on teaching population topics, teachers need to organize a personal plan for introducing population topics into the curriculum. This strategy would include: (1) a description of the population education objectives appropriate to the individual and comfortable to the individual teacher; (2) an assessment of the helps and hindrances to implementation in the local situation, and a consideration of resources, administrative, departmental and interdepartmental factors which might influence population education; and (3) a delineation of a plan of action.

In any given instance the teacher's objectives should be appropriate and not peripheral to the established teaching assignment. A few examples may help to clarify this first point in the personal strategy. The teacher may plan to emphasize the historical sequence of population events. This history may focus on population events in a particular community or in a nation. The teacher could link this population study to the traditional history course. Another teacher might plan to emphasize biological relationships such as carrying capacity and population size. A family life teacher would more than likely integrate the notion of the social consequences of personal decisions on childbearing.

Second, a teacher must appraise the helps and hindrances he will meet in implementing population education. He will need to weigh the relative importance of resource, administrative, and departmental factors. A few of the potential helps might be the availability of films, readings, student exercises, appropriate textbooks, and support from colleagues. A few of the potential hindrances might be student or administrative resistance, insufficient teaching backgrou !, and a lack of materials for specific grade levels. Maximizing the helps and circumventing the obstacles to implementation should be a part of the personal strategy for population education.

Finally, the plan of action should include the target class or adult group, a list of topics, a time limit in which to implement, and a basic collection of learning activities that correlate with existing curricula. The detail and scope of the plan would vary with each situation. However, in the plan of action the teacher should select a specific audience and a special time for implementation. This helps establish a goal and helps offset some of the random feeling inherent to the infusion strategy. A group of teaching ideas integrated with existing course content and assembled before the time of implementation gives the teacher security and a concrete means of dealing with the topic.

Guidance for Implementation

> Guidance for the implementation of population education should be provided by interested teachers and by consulting teams.

Population education curriculum is dependent on the individual teacher. Most

teachers will need implementation guidance at the classroom level. The primary way to meet this need would be to focus on the volunteer teacher. This teacher, who has special interest in population education and is in touch with a specialist or resource person, should function directly with co-teachers at the individual school or classroom level. This would be invaluable to the implementation process. In this way population education could be initiated and maintained in many settings.

Even if leaders in population education encourage individual teachers to train their colleagues in population content and method, it is very likely that additional guidance will still be needed. One alternative for meeting this need would be to establish consulting teams in selected areas of the country or region within a state. This method would definitely need to be piloted to test its feasibility, but such an operation has the potential for providing implementation guidance for various audiences. The teams could be comprised of individuals who have written or researched on population education and related topics and of practicing teachers. The researcher and specialist who is knowledgeable and interested in population education would provide the theoretical input needed for good implementation. The creative and motivated teacher who is experienced with curriculum in a selected setting could provide the skills needed to make practical applications. These teams could serve a limited area. Even if contacts involved only interested teachers and school systems, population education would still be promoted. Much could be learned about the patterns and processes of implementation.

Research on Implementation

> Population educators need to find a practical and efficient way of tracing the implementation of population education in schools in the United States.

Without a doubt much of the history of population education is going unrecorded. It is nearly impossible to take action which meets the needs of the teacher without a full account of what and how population topics are being taught and a record of the factors which are influencing the implementation of population education at the grass roots level. The record keeping process is a difficult but necessary task if population education is to spread further in the educational system. Barriers which influence implementation processes are not well defined in the educational community at large and research should begin to ascertain what helps and hindrances are pertinent to population education.

It is difficult to project how the implementation process can be monitored without elaborate and costly mechanisms. It is also difficult to find a method of tracing implementation that will be both convenient and appealing to teachers. Any method of tracing implementation must be suitable to the classroom situation and adapted to ordinary teaching routines.

The method must be aimed at (1) documenting the population topics taught and the methods used, and (2) investigating the needs and priorities teachers have for integrating population issues into existing curricula.

This would be a sizeable project for any researcher. Surveys directed at a given school system or else a larger audience would be one standard approach. A single system or limited group of systems could serve as a pilot study. The content of the survey could be aligned with population topics known to exist in textbooks used in the school system. One could discern more concretely how population issues are being taught and how they can be expanded. Problems could be

identified at the local level and the teachers themselves might suggest solutions they feel are appropriate for their situations. The overall practicality and efficiency of this approach would depend on feedback to the teachers and action to meet their needs.

Perhaps one follow-up approach would be to solicit the help of established publishing companies. Publishers have vested interest in teaching materials and curriculum changes. They also have the requisite resources to produce texts, workbooks, and student activities. If publishers were used, there would be no need for creating new structures for designing and distributing curriculum materials.

A second alternative for monitoring implementation would be to devise an evaluation system for the actual materials used. If a teacher had access to prepared population lessons, ones that were easy to use and duplicate, these lessons could be systematically evaluated. Readings, games, paperbacks, and the like could also be rated by teachers.

For example, activity sheets could include a tear-off portion that is ready to mail. This portion would provide information on the topics covered, how the lesson was used, problems met in implementing, and even student responses. The same could be done for population films.

The recipient of the evaluative reports--publisher, film distributor, university researcher, or population center--could deal with these data and take steps to improve the quality of the teaching resources and the range of their distribution.

The method as a whole would be an efficient way for tracing the implementation of population education in schools. It could be applied at the system level or even at the national level. Again, the most important consideration is to keep the needs of the teacher as a priority and to direct the outcome to his benefit.

REFERENCES

Gustavus, Susan O. and Huether, Carl A. "Population Education in U.S. Schools: A Status Report," Family Planning Perspectives 7. (September-October 1975), pp. 203-207.

Lane, Mary Turner and Wileman, Ralph. A Structure for Population Educatic Chapel Hill, North Carolina: Carolina Population Center, The University of North Carolina, 1974.

Massialas, Byron G. "Population Education as Exploration of Alternatives," Social Education 36. (April 1972), pp. 347-356.

Pincus, John. "Incentives for Innovations in the Public Schools," Review of Educational Research 44. (1974), pp. 113-144.

Population Reference Bureau, Inc. "Population Education: A Challenge of the Seventies." Washington, D.C.: February 1970.

Thorne, Melvyn. "Getting Population Education into a Public School System: Lessons Learned in Baltimore," Family Planning Perspectives. (December 1975), pp. 260-263.

Viederman, Stephen. "Needed Research in Population Education," The Journal of Environmental Education 4. (Summer '73), pp. 51-55.

Viederman, Stephen and Wayland, Sloan. "In-School Population Education," In Information, Education and Communication in Population and Family Planning (ed. by W. B. Johnson, et al., Chicago: Community and Family Study Center, University of Chicago, 1973, pp. 120-135.

Wayland, Sloan. "Population Education as it Exists Today: A Global Perspective." Paper presented at the Population Education Conference, Carolina Population Center, Chapel Hill, North Carolina, May 1972.

NATURAL ENVIRONMENT

SEQUENTIAL COMPARISON INDEX: A PRACTICAL MEANS OF ASSESSING ENVIRONMENTAL COMPLEXITY

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Use of the outdoors has become an integral part of the curriculum in many schools during recent years. The frequency of articles describing student activities in environmental education involving outdoor studies of pollution and its effect on ecosystems has increased. Students have observed environmental problems through direct participation in massive projects concerned with regional environmental issues (Ohio Schools, 1972). Others have studied the stability of aquatic communities (Murray and Jernigan, 1973) and ecosystems (e.g., Nacke, 1973). In at least one instance high school students were responsible for preparing part of an environmental impact statement (Cochran, 1973).

As one teacher has stated:

> "Today students are enthusiastically interested in environmental issues, and a wise teacher can channel this interest into a truly exciting learning experience as part of a field-biology research project. At the same time local governments, agencies, and business concerns have need of biologic information concerning the environment, and a well-done biologic survey can perform a valuable service to the community while also building good community relations." (Cochran, 1973, p. 518).

Despite their increase in environmentally-oriented activities, many teachers are still reluctant to use the outdoors as a classroom. This reluctance of the teacher often is due to a limited background in science, especially with regard to taxonomic identification of organisms likely to be encountered in the outdoor classroom. This qualitative deficiency is most acute when quantitative studies are conducted to demonstrate pollution or to study ecological stability or succession. Most quantitative methods currently available have been developed for use by trained individuals who must identify organisms to genus or species. What elementary and secondary teachers require is a scientifically valid method which is easily applied in assessing environmental quality. This method should have qualitative and quantitative aspects but not require the taxonomic expertise used in more sophisticated methods.

The Sequential Comparison Index (SCI) in a model for assessing the relative health, complexity or state of succession of biological communities through the determination of relative organism diversities (Cairns and Dickson, 1971; Paul, Buikema and Teates, 1976). The SCI provides a simple and inexpensive means for calculating diversity indices without having to identify organisms to genus or species. All that is required is that one can differentiate A from B, B from C, etc.

As Odum (1971, p. 152) stated, "one needs only to be able to recognize

species, not identify them by name. Errors resulting from failure to distinguish between closely similar species or counting life history stages as separate species are not critical because (1) closely related species are not apt to be found in the same sample, and (2) different life stages are, in themselves, part of diversity."

The SCI, which is based on the quality (variety) and quantity of organisms found in tne community, assumes that: (1) the diversity of organisms in that community is a measure of the stability or complexity of that community, and (2) that pollution introduced into a community causes a reduction in its stability and complexity.

Diversity as discussed in this paper involves both species numbers and the number of individuals per species. A community which has ten species and 250 individuals would have a lower diversity index than would a community with twenty species and 250 individuals. If you consider only the total number of individuals in a community, it is not a good index of complexity or stability. Odum (1971) correlated diversity and stability; however, he cautions that this correlation may not be a cause and effect relationship. Physically altered ecosystems usually have a high species diversity. Mature ecosystems are considered to be stable because of their high diversity and complexity.

Stress on an ecosystem resulting from the application of the insecticide Sevin has been illustrated by Barrett (1969). The number of species declined markedly in the treated area, while the number of individuals per species increased. Consequently the species diversity index decreased upon application of the insecticide. Other studies reported by Odum (1971) indicate that introduction of a pollutant into an ecosystem also reduces the species diversity.

The SCI originally was designed by Cairns, et al., (1968) for non-biologists to simply assess the effects of pollution from waste discharges on bottom-dwelling aquatic organisms. However, it is equally useful in the study of any community, including non-aquatic communities. The SCI is not a precise research instrument but it is a general instrument that can be used to identify communities which may require more detailed studies.

The initial step in calculating a SCI for a given community is the collection of organisms. The sample should be obtained by standard collecting procedures specified for that habitat. Emphasis should be given to random sample collection. Samples which contain a minimum of 250 organisms provide the most reliable species diversity indices. After collection, the sample must be thoroughly mixed to ensure randomized distribution of individuals. The analyses of the community sample may be conducted in various ways. For example, samples kept in liquids may be mixed and poured on to a counting grid with organisms being recorded from left to right row by row. If the system appears to be so delicate that removal of organisms will disrupt the community, the SCI may still be applied. In this case, each organism observed is assigned a code number or letter which is recorded on a separate slip of paper. Students may then mix the slips of paper and then randomly draw them from a bowl.

Once an organism has been selected the investigator must determine whether the individual being observed is the same as, or different than, its immediate predecessor. This information is recorded with the use of X's and O's. The first individual examined is recorded as an X. When the second individual of the sequence is observed, it is recorded as an X if it is the same as the first or as an O if it is different. In each instance, when an individual is different

from the previous individual observed, then you must switch from the current code, X or O, to the opposite code, O or X. This process is repeated until all individuals have been recorded. The information (X's and O's) must be recorded in a linear fashion so that the exact order in which the organisms were observed is maintained. This procedure may result in data having the following sequence: XXXOOXOOOOXXOOO.

Next, the number of runs must be determined. This is accomplished by counting the groupings of X's and O's. The first run begins with the first X and continues until the appearance of the first O. The successive O's represent the second run while the next grouping of X's represents the third run, etc. In the example previously provided there are six runs as underlined and counted below.

$$\text{Runs:}\quad \underset{1}{\underline{XXX}}\ \underset{2}{\underline{OO}}\ \underset{3}{\underline{X}}\ \underset{4}{\underline{OOOO}}\ \underset{5}{\underline{XX}}\ \underset{6}{\underline{OOO}}$$

The next piece of data required is the total number of organisms. The total number of organisms is equal to the total number of X's and O's recorded.

The organisms may now be segregated into distinct groups of individuals. This allows the investigator to determine the appropriate number of equivalent species present.

The diversity index may then be calculated using the following formula:

$$\text{Diversity Index} = \frac{\text{number of runs}}{\text{total number of organisms}} \times \text{number of equivalent species}$$

If there were three (3) distinct groups or species of organisms in the above example, the species diversity index would be 1.2.

$$\text{Diversity} = \frac{6}{15} \times 3 = 1.2$$

Generally, a low diversity index indicates less stability or complexity while a high diversity index indicates greater stability or complexity. A species diversity index of a single sample provides little information. A series of samples and their diversity indices are needed to assess the relative stability or complexity of a community. For example, in an aquatic ecosystem, such as a stream, samples of bottom-dwelling organisms could be taken at intervals above and below a point of stress; e.g., a municipal discharge. In a hypothetical example the following diversity indices were obtained as we moved downstream in a river: 15.4, 13.8, 14.7, 7.1, 15.0, 14.2. The 7.1 diversity index indicates a potential problem because the diversity index was lower than those from other sites. This could indicate a less stable or complex community. Further investigation would be required to determine if this decreased diversity was the result of pollution or some change in natural factors such as the substrate of stream bottoms (e.g., silt). Through application of this method, middle school students in northern Virginia located a leak in the local sewer lines that was polluting a stream that passed near their campus.

The SCI may be simulated in the lab prior to students using the method in the field. Substitutes for organisms may be any handy items such as nails, nuts and bolts, seeds, etc. Practice with the SCI prior to field use will lead to more efficient use of field time and a better understanding of the concepts upon which the SCI is based.

As previously described, the SCI can be used to determine community stability and indicate probable areas of man's perturbation of ecosystems. The SCI also may be used to study the relationship between successional stages and stability. Early successional stages have lower diversity indices than communities in later successional stages. In the classroom this effect can be observed by sampling the successional stages of a small aquarium seeded with pond water, hay infusions, etc. The SCI also provides a method for studying the effects of school ground microclimates on vegetation and associated fauna. Suggested comparisons include north and south sides of the building, areas under or around air conditioning units, and areas of high density student travel versus low density student travel.

REFERENCES

Barrett, Gary W. "The Effects of an Acute Insecticide Stress on a Semienclosed Grassland Ecosystem." Ecology, 49: 1969, pp. 1019-1035.

Cairns, John, Jr., Douglas W. Albaugh, Fred Busey and M. Duane Chanay. "The Sequential Comparison Index - A Simplified Method to Estimate Relative Differences in Biological Diversity in Stream Pollution Studies." Journal of the Water Pollution Control Federation, 40: September, 1968, pp. 1607-1613.

Cairns, John, Jr., and Kenneth L. Dickson. "A Simple Method for the Biological Assessment of the Effects of Waste Discharges on Aquatic Bottom-Dwelling Organisms." Journal of the Water Pollution Control Federation, 43: May, 1971, pp. 755-772.

Cochran, Tom. "Oregon Students Help Prepare Impact Statement." American Biology Teacher, 35: December, 1973, pp. 518-520, 537.

Murray, Jerry P., and Jernigan, Dean. "Establishing a K-12 Environmental Science Program in a Large Suburban School District." Science Teacher, 40: May, 1973, pp. 52-55.

Nacke, John M. "The Aquatic Ecosystem: A Unit Project." American Biology Teacher, 35: September, 1973, pp. 345-353.

Odum, Eugene P. Fundamentals of Ecology. Third Edition. W. B. Saunders Company, Philadelphia, Pennsylvania. 1971.

Ohio Schools. "The Cuyahoga Under a Microscope." December 22, 1972, pp. 16-18, 31-32.

WILDERNESS PRESERVATION AS ANTI-PROSTHESIS: A NEW PERSPECTIVE ON CARRYING CAPACITY AND TECHNOLOGY

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Abstract

Wilderness containing scarce, but usable, resources is endangered by industrial development. In recreation, wilderness experience is endangered by excessive artifacts brought into an area by its users. Human artifacts are "prosthetic devices" which extend the human body apparatus and multiply human ability to occupy diverse niches. The human carrying capacity of an environment depends not only on the resources it can provide but also on the population's organization and prosthetic technology. Technology and organization used to enlarge carrying capacity; now they often tend to reduce it. The number of users an area can accommodate before the wilderness experience is degraded may be larger for non-prosthetic man than for excessively prosthetic man.

KEY WORDS: technology, carrying capacity, recreation, wilderness, prosthesis

The Issue

When Henry David Thoreau (1893) stated that "In wildness is the preservation of the world," he typified the view of American transcendentalists (Porter, 1962, p. 4). But Thoreau put a sigh of relief into words when he wrote, "Thank God men have not yet learned to fly so they can lay waste the sky as well as the earth" (Porter, 1962, p. 7). Ironically, a century later Charles Lindbergh admitted that if he had to choose "I would rather have birds than airplanes" (Strohm, 1975, p. 8).

Both statements refer to an issue which has accompanied the American wilderness preservation movement from its beginning -- technological progress versus the costs of that progress in terms of environmental sacrifice. Wilderness[1] is in imminent danger because it contains usable resources at a time when the scarcity of those resources is magnified almost daily (Goldsmith, 1971, p. 250). In fact, this very fear is spelled out rather clearly in the wording of the Eastern Wilderness Act (U. S. Congress, 1975). But wilderness is not only threatened by industrial utilization; many believe the quality of wilderness environments, and the quality of a wilderness experience, are prone to degradation by the array of

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1. The term "wilderness" as used here does not necessarily mean those areas legally designated as such by the Wilderness Act of 1964, but is more inclusive. It refers to remote areas recognized primarily for their natural attributes.

artifacts wilderness users bring with them to natural areas. This paper deals with both levels of this threat.

Homo sapiens: The Prosthetic Species

The threat to wild habitats arises from the special characteristics of the human species. As Boughey (1975, p. 15, p. 79) has recently pointed out, human populations "have uniquely acquired the ability to adapt to niche diversification by cultural evolution....members of the genus Homo became progressively more specialized in object use and eventually in tool manufacture." As Hawley (1950, pp. 24-25) had said earlier, "Whereas other animals depend largely on genetic changes for adaptation to environment, man's chief form of adjustment has been through agencies external to himself but largely of his own fashioning. Instead of developing claws, wings, hard shell coverings, horns, etc., man has constructed tools, clothing, weapons, and various other devices from the materials of his environment."

"Prosthesis" -- a medical word that refers to the replacement of a missing or defective part of the human body, such as a limb, a tooth, or even a heart, by an artificial substitute serving the same function as its original counterpart -- would be useful in the vocabulary of human ecologists for describing these distinctively human means of adaptation. Technological extensions of man's bodily apparatus and capabilities help to extend our species' range and increase the carrying capacity of our habitat (Catton, forthcoming). The atlatl, for example, extended the spear-throwing arm of the primitive hunter and enabled him to bring down game that would have escaped a missile hurled less forcefully by an unextended arm. Prosthetically equipped tribes could harvest more of the sustenance provided by wild nature.

Homo sapiens have developed many "detachable organs" and skills not provided genetically to members of our species. Technology (from the cave man's open fire to the hydroelectric or nuclear power station, from the first pottery to the modern supertanker) has multiplied many times the ability of mankind to fill diverse niches. (As Lindbergh was aware, the technology of aviation made Homo sapiens competitive with other avifauna for the world's limited air space.)

The idea of a "super-technology" was, in the early 1900's, a universal American dream (Dubos, 1974, p. 146). Technological progress was equated with "goodness" and was seen as the most desirable of America's goals. Largely on the basis of a still persistent assumption of unlimited carrying capacity, humans have avidly encouraged the production of ever more elaborate and powerful prosthetic devices. Today we even see prosthesis of the human brain in the form of computers and pocket calculators. What the ecologist gains by calling the whole array of human tools "prosthetic devices" is a clear realization that these extensions of the human organism make each one of us, in effect, a larger creature -- with a larger environmental impact per capita than we would have as mere two-legged mammals.

Prosthetic technology has given humans the capability of fully exploiting almost any conceivable niche on this planet, if we so desire (Hawley, 1950, pp. 161-162; Fuller, 1970, pp. 174-180). Wilderness enthusiasts, recognizing this potential, have fought and no doubt will continue to fight the probable destruction of natural areas by both industrial prosthesis and recreational prosthesis; the former due to increasing demands for scarce resources and the latter due largely to the increasing numbers and types of wildland recreationists who bring with them recreational artifacts which may either extend or buffer their interaction with the natural environment. As will be discussed shortly, these artifacts may

not alter the physical environment, but they may affect also the psychological environment. That is, they may disrupt the perception and enjoyment of the natural environment by other persons.

An Ecological Model

Various anthropologists have recognized the applicability of the biologist's or the range manager's concept of "carrying capacity" to the environments upon which human societies depend (Allan, 1949; Brush, 1975; Vayda, 1969; Zubrow, 1971). We suggest that the relationship between technology and carrying capacity can be highlighted not only by regarding Homo sapiens as the prosthetic species, but also by making heuristic use of the "POET" notation introduced by Duncan (1961, p. 145). P stands for population; O stands for the organization of a human population, including institutions, norms, etc.; E stands for environment or habitat (including resources); and T stands for technology. In Duncan's view, human ecology is the study of all the interrelations among these four classes of variables. Extending Duncan's notation, then, we can let P_{max} = carrying capacity (maximum supportable population) and write the hypothesis

$$P_{max} = OET \qquad \text{(equation 1)}$$

which says the carrying capacity for human population is a function not only of the environment's resources but also of a population's organization and its technological capabilities. More specifically, equation 1 specifies that if technology is increased then so is carrying capacity, for more technology can render more of the environment's resources humanly usable. (So does more advanced organization.)

In the early 1900's this was certainly the case. Indeed, human history since the discovery of fire and the invention of clothing has been characterized by one prosthetic advance after another, each followed by a further increase in carrying capacity (Boughey, 1975, p. 251). Increments of carrying capacity have always been followed by growth of population.

Today, however, what environmentalists are arguing can be expressed by relating Duncan's variables differently:

$$P_{max} = OE/T \qquad \text{(equation 2).}$$

In other words, the environmentalists are telling us that technology now tends to reduce carrying capacity rather than increase it, because (1) our prosthetic devices compete with us for scarce finite resources -- e.g., air, water, space, and fuel; and (2) many of these prosthetic devices emit toxic extrametabolites (pollutants) into our environment. Goodman (1970, pp. 103-117) discusses this latter problem in particular. Furthermore, some environmentalists even seem to be saying that

$$P_{max} = E/(O + T) \qquad \text{(equation 3)}$$

or

$$P_{max} = E/OT \qquad \text{(equation 4).}$$

Equation 3 refers to situations in which organization and technology both tend to limit carrying capacity. Equation 4 describes instances in which organization has a multiplying effect on technology (or when human technology causes an increase in organization or in the number of persons having an impact upon a

particular habitat).[2]

In short, according to environmentalists, not only the prosthetic technology which used to be our servant has become our competitor, but organization which used to facilitate our use of servant-technology has now become an intensifier of competition.

Recreational Prosthesis

1. Social Carrying Capacity

During the past few years, wildland recreation researchers have begun to examine closely the outdoor recreation experience from a behavioral perspective (Driver and Tocher, 1974). No longer is the quality of such an experience measured solely on the basis of site characteristics. Many authors (Absher, 1972; Catton, 1966, 1969; Hendee and Catton, 1968; Hendee, et al., 1968; Lime and Stankey, 1971; Lucas, 1963, 1964, 1971; Shafer and Mietz, 1969; Stankey, 1971, 1972, 1973; Wager, 1964, 1966) have suggested and generally shown that a social-psychological concept which closely parallels the notion of biological carrying capacity may be used by researchers to explain the degradation of a person's wildland experience in much the same way that biological carrying capacity is used by ecologists to explain the degradation of an animal population's habitat from overuse. The concept is generally labeled "social carrying capacity"[3] and refers to the maximum interference from competitive use a wildland visitor can encounter before his or her experience on a given site begins to degrade. Interference may take the form of physical site damage, litter, etc., but it may also consist of the presence of too many other users, noises, aircraft overhead, or other signs of man's presence.

The more prosthetic man becomes, the more "signs of man's presence" this entails. A conceptual scheme that includes "carrying capacity" and "prosthesis" can help clarify the theoretical implications of some recent research. Lucas (1964) reported that canoeists objected more to motorboat users than did motorboaters to canoeists in the Boundary Waters Canoe Area. Lucas and Stankey (1972, p. 13) interpreted this and similar findings as evidence that different social carrying capacities are perceived by different types of users, and similarly that recreationists involved in more solitude-oriented activities (e.g., canoeing) were

[2]To understand the interaction of O and T, consider the various impacts a fixed number of man (P) may have when they enter a wildland area. The equipment (T) they take with them, and the manner in which they organize their activity (O) will jointly influence their reaction upon the environment. With no power-driven equipment their impact may be negligible. With one chain saw, they can have considerable impact. But it matters whether the men are equally competent to operate the chain saw and can take turns, or whether only one can do so. If all are competent to operate the device, they can collectively have more impact with two chain saws than with one. But one man alone, or one operator plus several non-operators, would have no more impact by virtue of possessing two chain saws than one, as he could use only one at a time. Thus, the number of persons (P) behaving in a specified way can be one parameter of organization (O).

[3]Sometimes referred to as "psychological carrying capacity". For instance, see Conservation Foundation, 1972, p. 2.

the most prone to experience degradation resulting from encounters with other types of users. (See also Lime and Stankey, 1971.)

The same type of phenomenon may occur in non-aquatic natural areas in which mechanized recreation is not excluded. Trail bikes, snowmobiles, and four-wheel drive vehicles all constitute recreational prosthetic devices which extend the capabilities of their users but lower the social carrying capacity of an area for nearby non-users of these devices.

It is also known that even some types of non-mechanized prosthesis may produce such consequences. For instance, Stankey (1973, p. 17) reported that back-packers objected more to horseback riders than did horseback riders to back-packers. The horse represents a prosthetic extender of the range of human mobility far beyond its normal territorial extent. But mere evidence of horses having been present may affect a hiker's experience adversely. As Stankey found, hikers object to muddied trails and manure left by horse parties.

To generalize: It would appear from available research that the seeker of solitude can experience deprivation as a result of either direct or indirect encounters with varying degrees of prosthesis in a remote natural environment. Increasing recreational prosthesis lowers social carrying capacity -- the total number of users an area can accommodate before experiences decrease in quality.[4]

2. The Biocentric Perspective

In light of the "prosthesis" concept these studies have clearer relevance to the attempt by Hendee and Stankey (1973) to summarize the U. S. Forest Service's position on wilderness management in a philosophy they call "biocentrism". It is contrasted with anthropocentrism. In biocentrism, as the name implies, management activities revolve around the central goal of maintaining the integrity of the natural environment. Anthropocentrism, on the other hand, takes human use of the environment as its primary benefit. Hendee and Stankey (1973, pp. 536-537) hold that anthropocentrism would allow pure wilderness to be eroded by decisions to accommodate increasing numbers of convenience-oriented recreationists. They argue that the availability of inexpensive modern camping equipment (recreational prosthesis) is partially responsible for this anticipated increase in

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[4] For a tongue-in-cheek, futuristic look at the state of wildland recreation on this nation's tricentennial (2076 A.D.) see Levin, 1970. The degree of prosthesis necessary to exceed desired thresholds of solitude, however, can be the subject of serious investigation (Lucas and Stankey, 1972, p. 13). It is suggested here that the negative relationship between abundance of recreational prosthesis and social carrying capacity may hold for all degrees of desired solitude. It is conceivable that for any type of wildland recreationist there is some minimum degree of prosthesis which, if encountered, will exceed his desired level of solitude. For instance, a helicopter hovering a short distance overhead may degrade the recreational experience for the driver of a four-wheel-drive vehicle, just as the latter degrades it for backpackers. It must be noted, therefore, that the total number of users entering the area is expressed in O (rather than in P_{max}) and may exceed the number who could be accommodated without degradation of the experience; it is the latter number that is denoted by P_{max}. Similarly, the total number of animals grazing in a pasture may exceed (temporarily) its carrying capacity -- the number it can support without degradation of its flora.

use.[5]

Increasing popularity of wilderness recreation results in an array of management problems which have to be dealt with through already conventional techniques we might call "preventive prosthesis". As noted by Hendee and Stankey (1973, p. 537), these include "protective developments such as roads, trails, toilets, and traffic barriers to control use and preserve the environment". Experience has indeed shown that small remote natural areas, once popularized, often become developed campgrounds. Such development constitutes a loss of wilderness quality and results in a reduction of wilderness-oriented recreationists using the area, thus lowering P_{max} for that type of user, as in equations 2, 3, or 4. In equation 4, which seems most applicable to this case, O and T are represented as a product rather than as a sum because the technology (in this instance cheap, available equipment, etc.) acts to multiply the number of other users attracted to wilderness recreation. But the essential point is that T now goes in the denominator rather than in the numerator (and perhaps so does O).

Efforts of agencies managing recreational wildlands to counter some of the degrading effects of recreational prosthesis with "protective developments" (or "preventive prosthesis") exemplify a trend seen elsewhere and typical of our era. Degrading effects of such range-extending technology as the automobile have evoked such preventive prosthesis as costly smog-control devices. Industrialization, which seemed to enlarge the human carrying capacity of whole continents, has evoked organizational as well as technological attempts to mitigate its side effects -- e.g., the 1972 United Nations Conference on the Human Environment; the National Environmental Policy Act of 1969, with its mandate for a new industry of Environmental Impact Statement-writing; etc.

Industrial Prosthesis

1. Wilderness Values in Jeopardy

Probably the most avid early defender of wilderness from utilitarianism was John Muir (1973a; 1973b), who feared the destruction of his beloved Yosemite by timber and sheep ranching interests. Like his predecessor Thoreau, Muir (even in those early days) sensed the finiteness of America's natural resources. His heated displeasure toward Gifford Pinchot, the father of forest management in the United States, was catalyzed by an ever-present fear that as demands for forest resources increased, so would the possibility of encroachment on wilderness.

Today, friction corresponding to that between these two figures is found in the political warfare between the Sierra Club (heirs of Muir) and the Forest Service (heirs of Pinchot). Issue after issue of the Sierra Club Bulletin highlights one controversy after another on which these two factions collide. Perhaps one article best epitomizes this animosity: Nancy Wood (1971) has attacked the Forest Service's clearcut method of timber harvest and regeneration, claiming that today it is the forests, and "tomorrow the national parks".

Other organizations such as the Wilderness Society and the National Parks and Conservation Association (NPCA) continue to launch similar attacks at human prosthesis as a threat to wilderness. Recently, the NPCA has diverted a great deal of its effort toward informing the public of the probable deterioration of parts

[5] Hendee and Stankey recognize that increasing experience may also tend to induce recreationists to pursue more primitive types of engagements later.

of Glacier National Park as a result of proposed coal mining, as well as gas and oil exploration and development along major drainages which extend into the park (NPCA staff, 1975, p. 20; Albert, 1975, p. 4).

The wilderness values being defended by such groups are quite diverse. Greenwood and Edwards (1973, p. 311) suggest two broad categories of these values: (1) scientific values, and (2) psychological values. Scientific values are those which give wilderness its function as an "ecological laboratory" and as a "genetic bank". Similarly, it is this function that gives wilderness a survival connotation for mankind (Brower, 1968). Psychological values are those primarily associated with the wildland recreation experience, though, as claimed by Darling and Eichhorn (1967, p. 16), many people may enjoy unaltered nature vicariously, just "knowing it's there".[6]

Besides the threat of damage to the physical environment, many authors have written of the probable destruction of biotic communities therein. Concerning wildlife, Dasmann (1968, p. 276) in particular states a case for our urgent need for representative populations of all wildlife species:

> The list of previously wild species that have suddenly made major contributions to human survival and well-being is long.... We do not know what previously unnoticed creature, living perhaps in some rain forest or at the bottom of the sea, may hold the key to [our] protection against some disease or environmental predicament that besets mankind. The value of saving wild things as a sort of 'life insurance' for humanity should be obvious.

2. The Eastern Wilderness Controversy: A Case in Point

Groups advocating wilderness preservation see the threats alluded to here as very real and in many cases immediate. Prior to the passage of the Eastern Wilderness Act in January of 1975, some preservationists went so far as to balk at this opportunity to add even more territory to the wilderness preservation system. Their apparently excessive purism becomes understandable in light of the conceptual scheme advocated in this paper, for these groups were impressively reluctant to risk any redefinition of "wilderness" that would imply availability of materials from such areas for the making of prosthetic human extensions. They feared that inclusion of second-growth eastern forests in the wilderness system would dilute the purity of the wilderness concept as embodied in already established western wilderness areas. After such a precedent, they felt, the future economic "development" of wilderness would be easier politically, because the nation would have officially condoned the idea that previously harvested forests met "wilderness" quality standards.

Partially for this reason, it was a separate Act of Congress, rather than an amendment to the Wilderness Act of 1964, that mandated the study and inclusion of eastern areas in America's wilderness preservation system.[7]

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[6] See also Gibson, 1966, where psychotherapeutic functions are discussed. The vicariousness of the wilderness experience was quite familiar to Thoreau (1893, 1899).

[7] Some even advocated a change of name to "wildlands east" in order to avoid equating these cut-over areas with pure, virgin wilderness.

Conclusion

In summary, the concerns environmentalists balance against technological and economic progress include these: the number of Americans who can benefit from wilderness diminishes as (1) the demand for industrial use of resources taken from wilderness increases, and (2) as more and more of us bring more and more recreational technology (and less biocentric attitudes) into the remaining enclaves of nature.

This paper has proposed a conceptual framework from which to view the wilderness preservation movement in America. Efforts toward maintaining the final vestiges of primitive America, when seen collectively as anti-prosthesis, can be recognized as manifestations of a deeply apprehensive concern about our environment's human carrying capacity and not merely as elitist expressions of esthetic pique. Throughout most of the world today, man is first and foremost an increasingly prosthetic species. His interactions with most of his environments are mediated and abetted by technology, often elaborate and overwhelmingly powerful. In those portions of the world specifically set aside as wilderness, however, man requires himself to be less prosthetic; he interacts with those specially designated environments more nearly as an intelligent but natural mammal, augmented much less than elsewhere by external apparatus.

Technological progress has increased the per capita consumption of resources. In a finite world, enlarged resource appetites spell intensified competition.

Wildland recreation research has begun to reveal that the social or psychological carrying capacity of an area can be greater for humans who remain non-prosthetic than for members of our species who become excessively prosthetic. There is an urgent need in a world of four billion ravenous resource users to pay close attention to such findings and to raise the question of whether the same principle holds in regard to biological carrying capacity.

REFERENCES

Absher, J. (1972). Response of Others to Sierra Club Wilderness Outings. In Wilderness Impact Study Report, Harvey, et al. (eds.). Sierra Club Outing Committee.

Albert, Gene (1975). Glacier: Beleagured Park of 1975. National Parks and Conservation Magazine, 49 (November): 4-10.

Allan, William (1949). Studies in African Land Usage in Northern Rhodesia. The Rhodes-Livingstone Papers Number Fifteen. Capetown: Oxford University Press.

Boughey, Arthur S. (1975). Man and the Environment, 2nd ed., Macmillan, New York.

Brower, David (1968). Foreword to Ehrlich, P., The Population Bomb, Ballantine Books, New York.

Brush, Stephen B. (1975). The Concept of Carrying Capacity for Systems of Shifting Cultivation. American Anthropologist, 77 (December): 799-811.

Catton, William R., Jr. (1966). Some Observations by a Sociologist Regarding Recreational Use of Wildlands: Sociological Research as a Recreation Management Tool. Paper presented at the Wildland Recreation Management Seminar, University of Washington, College of Forest Resources, Seattle.

Catton, William R., Jr. (1969). Motivations of Wilderness Users. Pulp and Paper Magazine of Canada, Woodlands Section (December 19): 121-126.

Catton, William R., Jr. (forthcoming). Overshoot: The Ecological Basis of Revolutionary Change.

Conservation Foundation, The (1972). National Parks at the Crossroads: Drawing the Line Where Protection Ends and Overuse Begins. CF Letter (Sept.), Washington, D. C.

Darling, F. F., and Eichhorn, N. D. (1967). Man and Nature in the National Parks. The Conservation Foundation, Washington, D. C.

Dasmann, R. F. (1968). Environmental Conservation, John Wiley and Sons, Inc., New York.

Driver, B. L., and Tocher, S. R. (1974). Toward a Behavioral Interpretation of Recreational Engagements, with Implications for Planning. In Fischer, Lewis, and Priddle (eds.), Land and Leisure: Concepts and Methods in Outdoor Recreation, Maaroufa Press, Inc., Chicago, pp. 91-111.

Dubos, Rene (1974). Beast or Angel? Choices that Make us Human, Charles Scribner's Sons, New York.

Duncan, Otis Dudley (1961). From Social System to Ecosystem. Sociological Inquiry, 31 (Spring): 140-149.

Fuller, R. B. (1970). Technology and the Human Environment. In Disch, R. (ed.), The Ecological Conscience: Values for Survival, Prentice-Hall, Inc., Englewood Cliffs, N. J., pp. 174-180.

Gibson, W. C. (1966). Wilderness -- A Psychiatric Necessity. In Kilgore, B. M. (ed.), Wilderness in a Changing World, The Sierra Club, San Francisco.

Goldsmith, E. (ed.) (1971). Can Britian Survive? Tom Stacey, Ltd., London.

Goodman, P. (1970). Can Technology Be Humane? In Disch, R. (ed.), The Ecological Conscience: Values for Survival, Prentice-Hall, Inc., Englewood Cliffs, N. J., pp. 103-117.

Greenwood, N., and Edwards, J. M. B. (1973). Human Environments and Natural Systems, Duxbury Press, Belmont, California.

Hawley, Amos H. (1950). Human Ecology, Ronald Press Co., New York.

Hendee, John C., and Catton, William R., Jr. (1968). Wilderness Users: What Do They Think? American Forests, 74 (September): 29-31, 60-61.

Hendee, John C., Catton, William R., Jr., Marlow, Larry D., and Brockman, C. Frank (1968). Wilderness Users in the Pacific Northwest: Their Characteristics, Values, and Management Preferences. USDA Forest Service Research Paper PNW-61, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Hendee, John C., and Stankey, George H. (1973). Biocentricity in Wilderness Management. BioScience, 23 (September): 535-538.

Levin, P. D. (1970). For Future Generations. Appalachia, 38 (2): 4-19.

Lime, D. W., and Stankey, George H. (1971). Carrying Capacity: Maintaining Outdoor Recreation Quality. In Recreation Symposium Proceedings, USDA Forest Service NE Forest Experiment Station, Upper Darby, Pennsylvania.

Lucas, Robert C. (1963). Visitor Reaction to Timber Harvesting in the Boundary Waters Canoe Area. USDA Forest Service Research Note LS-2, Lakes States Forest Experiment Station, St. Paul, Minnesota.

Lucas, Robert C. (1964). The Recreational Capacity of the Quetico-Superior Area. USDA Forest Service Research Note LS-61, Lakes States Forest Experiment Station, St. Paul, Minnesota.

Lucas, Robert C. (1971). Hikers and Other Trail Users. In Recreation Symposium Proceedings, USDA Forest Service NE Forest Experiment Station, Upper Darby, Pennsylvania, pp. 113-122.

Lucas, Robert C., and Stankey, George H. (1972). Social Carrying Capacity for Back Country Recreation. USDA Forest Service Intermountain Forest and Range Experiment Station, Ogden, Utah.

Muir, John (1973a). Wild Wool. In Worster, D. (ed.), American Environmentalism: The Formative Period, 1860-1915, John Wiley and Sons, Inc., New York.

Muir, John (1973b). The Yosemite. In Worster, D. (ed.), American Environmentalism: The Formative Period, 1860-1915, John Wiley and Sons, Inc., New York.

National Parks and Conservation Association staff (1975). Triple Jeopardy at Glacier National Park. National Parks and Conservation Magazine, 49 (September): 20-22.

Porter, E. (1962). In Wildness Is the Preservation of the World, Ballantine Books, New York.

Shafer, Elwood L., Jr., and Mietz, James (1969). Aesthetic and Emotional Experience Rate High with Northeast Wilderness Hikers. Environment and Behavior, 1 (December): 187-189.

Stankey, George H. (1971). Wilderness Carrying Capacity and Quality. The Naturalist, 22 (Autumn): 7-13.

Stankey, George H. (1972). A Strategy for the Definition and Management of Wilderness Quality. In Krutilla, J. V. (ed.), Natural Environments: Studies in Theoretical and Applied Analysis, Johns Hopkins University Press, Baltimore.

Stankey, George H. (1973). Visitor Perception of Wilderness Recreation Carrying Capacity. USDA Forest Service Research Paper INT-142, Intermountain Forest and Range Experiment Station, Ogden, Utah.

Strohm, J. (1976). Our Times Too, Call for Greatness. National Wildlife, 14 (December-January): 4-14.

Thoreau, Henry David (1893). Excursions, Houghton Mifflin Co., Boston.

Thoreau, Henry David (1899). Walden, T. Y. Crowell and Co., New York.

U. S. Congress (1975). The Eastern Wilderness Act (PL 93-622), January 3.

Vayda, Andrew P. (1969). An Ecological Approach in Cultural Anthropology. Bucknell Review, 17 (March): 112-119.

Wagar, J. A. (1964). The Carrying Capacity of Wildlands for Recreation. Society of American Foresters, Forest Science Monographs, No. 7.

Wagar, J. A. (1966). Quality in Outdoor Recreation. Trends in Parks and Recreation, 3 (July): 9-12.

Wood, Nancy (1971). Here Comes a Grim Reaper: Today the Forests, Tomorrow the National Parks. Sierra Club Bulletin, 56 (September): 14-19.

Zubrow, Ezra B. W. (1971). Carrying Capacity and Dynamic Equilibrium in the Prehistoric Southwest. American Antiquity, 36 (April): 127-138.

GOALS AND STRATEGIES OF WILDLIFE BIOLOGY

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Early man never worried about game management; he was too busy trying to stay alive. Large carnivores regularly took him as prey. Man soon learned that by banding together and using crude weapons, he could repel predator attacks and secure food and clothing for himself. With the invention of better weapons, man became a hunter and consistently took game. The bow and arrow provided meat for his table, but the rifle assured him a more plentiful supply. As the white man moved westward, his needs increased and the advancing railroad provided a means of merging supply with demand. By modern standards, such wanton killing of wildlife would be considered wasteful and greedy; but, by standards of the day, market hunting was acceptable. Subsistence hunting by railroad crews and market hunting for eastern consumption drove the Bison to the verge of extinction. During this period of our history, we began to realize that nature's horn-of-plenty had a bottom. Ideas about game management and land ethics were starting to take root.

Men with vision and power like Theodore Roosevelt and Gifford Pinchot, early conservationist and head of the Forest Service, began championing the natural resource cause. Forest and wildlife managers were being trained to perpetuate our natural birthright. A biologist of those early days slept under the stars and wore a gun that he knew how to use. He often took his food from the land. Such a mystique still lures many individuals to the profession. Biologists of today have traded their horse for a helicopter and their six-shooter for a statistics course. The glamourous, exciting field jobs still remain, but are associated with extensive field research and intensive analysis of field data. The goals of wildlife management to maintain healthy productive populations have never changed, but the principles and methods change as we learn more about the complexity of nature.

After the turn of the century, people realized that game populations were diminishing and something had to be done. A system of refuges was established and laws prohibiting or greatly restricting hunting were enacted. Within a few years, populations began to grow and hunting was allowed again. To ensure future populations, only the male of many species was hunted. Predator control programs were established to rid areas of "bad" animals such as cougars and bobcats. "Good" animals like deer, elk, and rabbits were protected. Populations rose tremendously; in some states deer population went over the million mark. During severe winters, large die-offs became the rule; populations exceeded the land's ability to support them. People soon realized that over-protection could be as harmful as no protection.

Management practices have changed. Predator control programs are the exception rather than the rule; biologists utilize a habitat approach to game management. All organisms in an ecosystem fill valuable and essential niches and should be considered when designing a management plan. Yet the most important aspect of a management proposal -- man -- can often be overlooked. In the case of the eagle, habitat exists in ample quantity. But, for years man has poisoned the eagle's food chain. Management in this case must alter land use practices and change

ingrained ideas. In the Southeast, loggers cut trees they suspect have heart-rot, thus destroying potential nesting sites for wood ducks, woodpeckers and owls. Biologists must convince loggers that some of these trees must be left. Again, good wildlife management means successful people management.

The biologist has a variety of tools that he uses to manipulate habitat and some of his best tools have come under strong public criticism. Clear-cutting of forests, fire, herbicides and chaining (clearing areas of pinyon-juniper stands with a large anchor chain pulled by bulldozers) when misused create environmental havoc. However, when used with moderation and control, such activities provide a reasonably cheap method of opening up dense vegetative cover and often have important values for natural resources other than wildlife. Such changes allow fresh, succulent vegetation to sprout, thus creating variety in an otherwise monotonous environment. Diversity improves an animal's chances of surviving because of increased food, cover and shelter alternatives created by the vegetative changes.

Fifteen years ago a discussion of wildlife management would have stopped with game species, but today non-game animals represent an equally important aspect of management. Fortunately, most game management plans also have the additional benefit of helping non-game species. Several state game divisions have non-game biologists, but their operating budgets reflect a low priority. On the surface this may seem unfair; however, a quick check on sources of wildlife funding reveals that the majority of management monies come from hunting license fees and sales of guns and ammunitions. To correct inequalities, the public can help greatly by supporting non-game programs, buying conservation stamps, and contacting their legislators concerning wildlife appropriations.

For many years biologists have acted somewhat like ostriches by trying to stay out of the public view. Also, managers often suffered from the "Messiah complex" -- thinking they were right was all that was needed to carry out a biologically sound program. Time has altered this trend and biologists now explain their programs and plans to the public. Yet more must be done; people must ask biologists and managers why certain programs are needed. Citizens must then try to help biologists accomplish important goals. Despite a concerted effort on all fronts, getting money to carry out wildlife programs remains a difficult task.

Many obstacles block the road to successful management. One created by modern film makers is a false representation of nature. The so-called "Bambi syndrome" gives human characteristics of wide-eyes innocence to grass-eaters and viciousness to meat-eaters instead of portraying their actual functions in nature. Much anti-hunting sentiment comes as a direct result of this syndrome. Hunting represents a useful tool for wildlife managers, but also a controversial one. Too often anti-hunting means anti-management and such actions, as have been clearly demonstrated, can lead to ultimate destruction of game and its habitat.

The key to future wildlife management does not rest solely with biologists, but also with educators. Educators and biologists have a responsibility to youth that has often been neglected. Educators must communicate with biologists so both may in turn help youth gain a full understanding of their responsibilities to a delicate environment. Nor should we be satisfied to advocate our responsibilities by waiting for others to take actions. A low profile is no longer a desirable attribute for a biologist or educator.

Our goal must be to maintain a productive environment for all organisms. Our strategy must be to enhance public awareness because the healthy environment needed by wildlife involves the welfare of everyone.

VALUES

ENVIRONMENTAL CRISES AND THE EVOLUTION OF HUMAN VALUES

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SHALL OUR BLOOD FAIL? OR SHALL IT COME TO BE THE BLOOD OF PARADISE AND SHALL THE EARTH SEEM ALL OF PARADISE THAT WE SHALL KNOW?

Wallace Stevens..."Sunday Morning"

Introduction

Robert Heilbroner in his book, An Inquiry Into the Human Prospect, has presented one of the most formidable challenges which confront the modern world by describing what he believes to be the probable course of history. Besieged by the growing possibility of obliterative nuclear war, a rampant population explosion, dwindling natural resource and energy supplies, and a general moral and spiritual malaise, Heilbroner views the future of mankind on the planet as desperate and irresoluble. Even if direct measures were undertaken immediately they would be of little or no avail in avoiding impending global famine, environmental catastrophes, resource depletion, energy shortages, and possible nuclear obliteration. Heilbroner has analyzed existing social, economic, and political systems and has concluded that they are inadequate to contend with these overwhelming exigencies. Humanity's only hope for survival rests upon the usurpation of power by totalitarian regimes using repression and coercion to direct a chaotic world through the coming dark ages.

Heilbroner's scepticism concerning the possibility of human adaptation rests on his analysis of the two great socioeconomic systems and their influence on human behavior. Since both socialism and capitalism are founded on the premises of ever-increasing production, unlimited economic growth, and unending progress, none of which are any longer feasible, neither system will be able to alter sufficiently human behavior patterns in time to ward off widespread catastrophes.

But along with the potential threat that mankind faces, Heilbroner has failed to consider the potential opportunity for cultural adaptation and creative human response. The inadequacies of existing political, economic and social systems to respond to these challenges indicates a deeper failure of currently prominent beliefs, behavior patterns, and value systems in relation to changing environmental conditions. The resolution of these conflicts requires a radical reevaluation and reassessment of the philosophical and ethical presuppositions at the foundation of the modern western Weltanschauung and the emergence of a holistic world view compatible with the realities of the ecosystem. The Ecovolution* of this new culture type involves nothing less than a total transformational reform

*Ecovolution - The simultaneous and mutually interdependent evolution of the human species in both biological and cultural contexts, the non-human species, and the physical environment.

in attitudes, principles, and values--a transformation which must occur if we are to move 'beyond doomsday' to the actuality of a desirable human future.

Historical Origins

The presumption which has contributed most significantly to the environmental crises of the present is the belief in the radical separation of man from nature. This belief probably had its origin during the transition from pagan animism to the more anthropocentric polytheisms which occurred over two and a half millennia ago. Once man was able to view himself as separate and above the natural world, there was no restraint to the thoughtless plundering of the planet to satisfy human desire. Historian Lynn White in his article, "The Historical Roots of our Ecological Crisis" asserts that the Judeo-Christian belief of human superiority, dominion, and transcendence over nature, the world view that sees nature as simply the stage for men to work out their ultimate destinies, is the origin of current ecological crisis: "...we shall continue to have a worsening ecological crisis until we reject the Christian axiom that nature has no reason for existence save to serve man." But regardless of where we locate the specific origin of the man/nature dualism, it is important simply to recognize that this presupposition underlies most of western philosophical speculation and is largely responsible for modern man's destructive relation (conquest) with nature.

We must now consider the second most important factor leading to current environmental crisis, the philosophical presuppositions of John Locke which were central to the development of modern liberal society, democratic government, capitalistic economy, and the contemporary value system. Locke's thought was largely an attempt to develop the philosophical consequences of the dualistic and mechanistic world view of Newtonian physics and elaborate the implications for morality, politics, and religion. As a result Locke reduces the whole of reality to correspond to the mechanistic movement of discrete atoms in a void. Persons are defined as totally independent, self-sufficient, and unrelated 'mental substances'. These assumptions concerning the nature of persons led to a political philosophy of 'possessive individualism' whereby society is composed of self-interested individuals who consent to public government solely for the protection of private property rights and to safeguard personal prosperity, acquisitiveness, and power. Implicitly assumed are norms of self-aggrandizement, material growth, undiminished increase, greater consumption, and unending progress. The goal for each individual is the unlimited expansion of material wealth. In economics these axioms led to the labor theory of value and laissez-faire free market economy of Adam Smith with competition serving as the only check to excessive greed. These beliefs were the rudiments of the value system that is currently prominent in American culture; what can be operationally defined as the ethic of anthropocentric hedonism. Salient features of this ethic include radical individualism, egoistic hedonism, the goals of quantitative progress and material growth, exploitation of nature for economic gain, primacy of private property, a utilitarian value of persons, competition and inequality as accepted norms, centralization of authority, a curative rather than preventative approach to problems, and seeing science and technology as adjuncts of the marketplace.

The third factor contributing to the modern day environmental crises was the rapid development of technology during the last two centuries without the corresponding development of an ethical system capable of directing and regulating the application of scientific knowledge. During the scientific revolution of the seventeenth century and the Enlightenment in the eighteenth century, there began the tendency to apply scientific knowledge to practical human affairs through

technology. But corresponding to the development of technology came the tendency to separate the natural sciences from philosophy and religion, resulting in what C. P. Snow has referred to as the two cultures of the sciences and the humanities. In modern ethical thought this tendency has resulted in the distinction between factual description and normative values, between the way things are and the way things should be. The devastating consequence of this radical separation of facts and values, of the sciences and the humanities, is what is known as 'reductionism'--the erroneous idea that reality is limited solely to scientific descriptions and explanations of physical, biological, and chemical processes and in no way includes goals, values, principles, or 'human nature'. The result of the reductionist fallacy was the lopsided development of western culture and the loss of any goals or values to regulate and guide scientific inquiry and the application of technology. Pure science failed to develop an ethical system to decide what ends should be sought, whether they comprised ends, or any other of the ethical considerations involved. Until the nineteenth century this situation had no great consequences for the simple reason that man's energy budget was still low in relation to the total system of the biosphere and any harmful effects on the environment were easily absorbed and equalized by the total ecosystem. But with the discovery and utilization revolution, technology was able to grow unchecked to the point where in the twentieth century it has now so drastically altered the physical and social environment that it undermines the stability of the entire ecosystem and threatens the survival of the human species.

Since both technology and the liberal political tradition are responsible for the critical problems which now confront the modern world, it is futile to look to them for solutions. The nature of these critical problems indicates the failure of traditional thought-patterns in providing accurate models of existing environmental realities. In the terminology of Thomas Kuhn, when the existing paradigm is no longer able to explain adequately anomalies, a 'revolutionary transformation' in thought is required to provide a higher order paradigm. A new paradigm would need to integrate an accurate and objective model of existing environmental realities with an ecological and humanistic value system. Evidence suggests that the beginnings of this new higher order paradigm are to be found in the systems approach to energetics as developed by H. T. Odum.

Sources for Evolution

Odum's work provides a model for the scientific understanding of the process of the ecosystem and man's role in partnership with nature. Odum applies established laws of energy to the complex systems of the biosphere. Each process in the biosphere is shown to have an energy basis. Odum's system approach reveals the functioning of three immutable laws which govern all energy flows: (1) the law of conservation of energy which states that energy is neither created nor destroyed; (2) the law of energy degradation or the second law of thermodynamics--in all processes some potential energy loses its ability to do work and is dispersed as heat; (3) the maximum power principle which holds that those systems survive which utilize available energy most efficiently. Of these three laws, the maximum power principle is most important for understanding the energy systems of man and nature. First formulated by Lotka in 1922, the maximum power principle regards energy efficiency as the prime criterion for natural selection. SYSTEMS SURVIVE WHICH UTILIZE AVAILABLE ENERGY MOST EFFICIENTLY (efficiency is here defined as the ratio of energy inflows to energy outflows or the most useful work done with the least amount of waste). Traditional Darwinian thought held that all organisms have as a fundamental goal the instinct to survive.

Through a process of random variation and natural selection those organisms survive which are best adapted to the environment. The maximum power principle expands and elaborates the survival as criterion for fitness with the notion of energy efficiency for an entire system. In competition for survival a system wins out over another if it is able to make better use of obtainable energies. This principle also provides for activities beyond sheer existence. Once basic needs necessary for the life process are met, systems tend to maximize energy by increasing order and diversity, improving control mechanisms and feedbacks to increase production and consumption of energy, doing useful work, or developing storages.

It is important to realize that the maximum power principle must be defined in the context of the 'given' actualities of the system. Ecosystems occur in primarily two conditions, that of growth and that of steady state. In growth, abundant storages and subsidies are utilized which rapidly accelerate power flows. In steady state, energy inflows are in equilibrium with energy outflows. The maximum power principle describes how a system functions according to the availability of energy; it is the availability of both the quality and quantity of energy which determines the maximum power. In growth states, each individual organism competes for survival by maximizing power flows, increasing energy production and consumption, accumulating storages, creating more order and complexity resulting in growth and progress of the entire system. This type of grow or perish expansion can only be maintained during periods of abundant and cheap energy subsidies, and is characteristic of young developing systems. Steady state is characteristic of older more mature systems with regular though limited energy sources. In steady state, Lotka's principle requires that those systems survive that do not attempt high growth patterns but instead use available energies in long-staying steady state activities. System energy efficiency takes precedence over individual organism energy efficiency, with emphasis on scability, diversity, smallness, and equilibrium. There is cooperation instead of competition with importance placed not on expansion but on contribution to the total system. Besides determining the operation of the system, the availability of energy also affects the human value system by setting limits on what goals and values are possible. It is now clear that what has been referred to as an ethic of anthropocentric hedonism and the entire liberal tradition were the result of the rapid growth period of the past two centuries which was subsidized by massive fossil fuel reserves. As these reserves are rapidly depleted, a new value system must emerge as we make the transition to steady state.

Conclusion

> Oil and coal will not run out, but the ratio of energy spent in obtaining them will continue to increase until costs exceed net yields. When the net yield of potential energy begins to approach that of wood, we will have returned to the solar-energy-based economy....Whether such change will come suddenly in a catastrophe or slowly as a gradual trend is one of the great issues of our time.
>
> H. T. Odum

The emergence of an environmentally conscious ethic is necessary to ease the transition back to steady state. If man is to remain on the planet the old value-system must be transformed and the two-century long values of growth

and progress must be seen now as a cancer threatening the life of the eco-system. We have it within our conscious powers to change not only ourselves but also our culture. The patterns of the outmoded and self-destructive culture must be transformed to meet existing needs of the system; nothing less than the evolution of a new ecologically sensitive humanistic-scientific culture type is required. Steady state need not mean a reduction of the quality of life but only different standards by which we judge the value of human life and our role in a harmonious relationship with nature.

ENERGY AND SELF-ACTUALIZATION

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In the branch of moral philosophy called normative ethics, there have been many attempts to specify the good that men ought to seek. Candidates for states of affairs held to be good in and of themselves have included pleasure, health, truth, beauty, peace, love, union with the divine, or some combination of these and other similar states of affairs. In this paper I wish to offer my understanding of the good men ought to seek, and to justify my understanding by showing how it incorporates other notions of what is intrinsically good into it and how it is compatible with the ways things are in the universe. Then I would like to show how this good can be attained through three types of self-actualization that are found in both pre-industrial and industrial societies. As I do this I also hope to show how the amount of energy available in a particular society affects the ways in which people actualize themselves or realize that which is good.

In doing all this I shall be performing a double task--one part normative or ethical and the other part descriptive or historical. On the one hand I will be suggesting what ought to be the good we aim at; on the other hand I will also be examining in a very general way the good that people have aimed at in the past and in our own day. While I am qualified to do the ethical task, I am not as qualified as an historian or cultural anthropologist. Thus the generalizations I will make about past societies must be regarded as very hypothetical, because I have not done the detailed historical study necessary to support them.

The Good Humans Ought to Seek

In its most general description the good humans ought to seek is nothing else than systems or harmonious arrangements of parts. A number of elements constitute the goodness of systems. The two most basic elements are, first, that the relationship between parts be harmonious or that the system be integrated with its parts mutually supporting each other, and second, that the integrity of each part in the system be preserved. According to this view of what is good every system, and hence everything that exists insofar as it is some kind of system, is good. However, some systems might be better than others, depending on two other elements that constitute the goodness of systems, their comprehensiveness and efficiency. Of two systems that are harmonious and in which the integrity of each part is preserved, the system which is more comprehensive or that includes a greater number and variety of parts is better. Further, of two systems that are harmonious, that preserve the integrity of parts, and that are equally comprehensive, that which is most efficient may be judged to be better than the other.

Although what I have just said sounds very abstract and you may wonder how this can be the good that humans ought to seek, it is easy to show that this is indeed what human beings have sought when they seek the good. Specifically, when people seek truth, beauty, love, physical and mental health, and pleasure, what they are really seeking to establish and maintain is some kind of system or a harmonious arrangement of parts. Truth for example, in its most general-

sense, is defined as the coherence of ideas with other ideas and the correspondence of ideas with experience. Truth is an harmonious arrangement of parts, namely of ideas and experiences. Beauty may also be understood in a sense, defined as the coherence of ideas with other ideas and the correspondence of ideas with experience. Truth is an harmonious arrangement of parts; namely of ideas and experiences. Beauty may also be understood in a similar manner. John Cobb, Jr. writes, "When we describe objects as beautiful we usually mean that they participate in a certain harmony of proportions and relations. Colors and shapes or sounds are so related with each other that each contributes to the whole in such a way that the whole in turn accentuates each of its parts."[1] Plays, symphonies, sculptures and paintings are systems in which the various components are harmonized together into a unified whole. Love, also, is an example of systems or harmonious arrangement of parts; in this case the parts are aspects of the people involved. Not only is the relationship harmonious but in true love the integrity of each individual in the relationship is preserved. As Eric Fromm, the psychologist writes, "Mature love is union under the condition of preserving one's integrity, one's individuality."[2]

If one moves from the social sphere of life to the individual, one discovers that physical and mental health, two goods which humans have always sought, can also be understood as the maintenance of systems or harmonious arrangements of parts. A biological organism is physically healthy when each of its parts is fulfilling its proper function in harmony with the other parts of the system. Physical disease is a breakdown in the harmony of the physical organism, either because the system is invaded by outside disruptive forces such as bacteria or viruses or because it simply breaks down in the aging process. Similarly, mental or psychological health is often considered by psychologists to be a state of harmony in which all the various components of the self can be experienced and acknowledged in such a way that they complement one another. Carl Jung's conception of the healthy human self as an integration of opposites, such as the conscious--unconscious, the masculine--feminine, or the clearly known--shadow aspects of the self, is just one example.

In each of the intrinsic goods I have just mentioned the two basic elements that make a system good are present. In each case there is an harmonious arrangement of parts, and the integrity of the parts is preserved. Insofar as ideas and experiences, colors and sounds, individual humans, physical organs, and mental and emotional components exist harmoniously together, there is something which is good, a system called truth, beauty, love, or physical and mental health.

However, some such systems are better than others depending on the degree of comprehensiveness of the system and the degree of its efficiency. When one compares two systems of thought, that which is more comprehensive or which includes a greater number and variety of ideas is judged to be the greater truth. Further, if two systems of thought are equally harmonious and comprehensive with the integrity of all parts being preserved, that which is most efficient in the sense of being the simplest or possessing the fewest number

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[1] John Cobb, Jr., A Christian Natural Theology: Based on the Thought of Alfred North Whitehead (Philadelphia: The Westminster Press, 1965), p. 101.

[2] Eric Fromm, The Art of Loving (New York: Harper Colophon Books, 1962), p. 20.

of basic assumptions is judged to be better. It was on the ground of intellectual simplicity or efficiency that the heleocentric theory of the solar system was first accepted over the older theory that held the earth to be the center of the solar system. These two criteria of what makes one system better than another may also be used in discriminating the more from the less beautiful. On the grounds of comprehensiveness a symphony would be judged to be better than a popular tune. Both can be beautiful, but the more beautiful is that which contains the greatest number and variety of sounds organized in a harmonious whole. And of two paintings of equal harmony, integrity and comprehensives, that which creates its effect with the fewest number of brush strokes may be regarded as the better of the two. When one considers the harmony of personal relationships in which individuals maintain their integrity, called mature love, as two lovers come to know and appreciate aspects of each other that were at first not known or shared, we can say that love grows and the relationship is better, because it is more comprehensive. Further, insofar as a system of human relationships is based on the fewest number of principles, we might say that a simpler system is better than one whose principles are more complex. Physical health is a state of affairs that is not often spoken of in terms of degrees of health, because a system of biological equilibrium is of such a nature that either a person is healthy or he is sick; nevertheless, it may be possible, once basic health is attained, to speak of better and worse physical specimens of a species. Thus for example, a championship athlete whose body is finely tuned to accomplish feats beyond the range of normal, healthy individuals, may be regarded as better because he can accomplish these activities more efficiently. Once the basic elements of a system--harmony and integrity of parts--are present, then systems can be judged to be better or worse in terms of their comprehensiveness and efficiency.

So far I have been attempting to show that the good which people ought to seek is systems or harmonious arrangements of parts on the grounds that this general understanding of the good expresses what people are seeking when they seek such traditional goods as truth, beauty, love, and physical and mental health. I have, however, omitted one state of affairs that more people consider to be intrinsically good than any other, namely pleasure, happiness, or the feeling of satisfaction or pleasantness, which are simply the emotional states that accompany the achieving and maintaining of systems or the harmonious arrangements of parts. Pleasure then is the felt counterpart of truth, beauty, love, and health, and it is an indicator that harmony has been achieved or is being maintained. Further, it might be possible that the more comprehensive and efficient a system, the greater the felt pleasure that accompanies it; hence the degree of pleasure might be an indicator of the degree of goodness of a particular harmonious arrangement of parts.

Not only have people sought to create and maintain systems of the types we have been considering when they seek that which is considered good, but the establishing and preservation of harmonious arrangements of parts is consistent with a basic value judgement that people have made when they say that creation of the world and the continual evolution of life and culture are good. Behind this fundamental value judgement are two general facts. The first is that creation is the creation of order or of harmonious systems and that evolution is the continual establishment of ever more comprehensive and efficient systems. The second general fact is that with the evolution of systems there is also an increase of disorder, expressed in the second law of thermodynamics as an increase of entropy. In terms used by Howard T. Odum, whenever energy is used to create structure, some of that energy goes down the heat sink and is lost as potential energy for the further

creation and maintenance of harmonious systems of parts.[3] Thus, the continual creation of the world is both an ordering and a disordering process, and, according to the second law of thermodynamics, disorder will win.

In spite of this projected outcome, the almost universal judgement of mankind throughout history has been that disorder or random motion is bad. Such judgement has been expressed in various religious traditions, which, for example, have viewed the world in terms of a conflict between order and chaos, with the good deities on the side of order, or which, in another example, have judged the order of the world to be good so that it can serve as a basis for the design argument for the existence of God. That religion has judged order to be good and disorder, bad is also exemplified in the fact that the term "religion" has even been defined in terms of order overcoming disorder. Anthony Wallace, professor of anthropology at the University of Pennsylvania, has written:

> The essential theme of the religious event...is the dialectic of disorganization and organization. On the one hand men universally observe the increase of entropy (disorganization) in familiar systems: metals rust and corrode, woods and fabrics rot, people sicken and die, personalities disintegrate, social groups splinter and disband. And on the other hand, men universally experience the contrary process of organization: much energy is spent preventing rust, corrosion, decay, rot, sickness, death, and dissolution, and indeed, at least locally there may be an absolute gain of organization, a real growth or revitalization. This dialectic, the "struggle" (to use an essay metaphor) between entropy and organization, is what religion is all about. The most diverse creeds unite in the attempt to solve the sphinx-riddle of the relationship between life and death, between organization and disorganization,...
>
> But religion does not offer just any solution: it characteristically offers a solution which assures the believer that life and organization will win, that death and disorganization will lose, in their struggle to become the characteristic conditions of self and cosmos....[4]

This same judgement that, whether or not it actually will, order ought to win out over disorder is expressed by physicist R. B. Lindsay in what he calls the "thermodynamic imperative."

> Life in the form of human beings has through thousands of years waged a relentless struggle to build a civilization which represents an attempt to increase the availability of energy for transformation or, as some would prefer to put it, to fashion order out of disorder. Even though the second law guarantees that the struggle will not avail and that we must all go down ultimately to defeat, the challenge to fight on is still there. To me it conveys the distinct suggestions that we as individuals should endeavor to consume as much entropy as possible to

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[3] Howard T. Odum, Environment, Power, and Society (New York: Wiley-Interscience, 1971), pp. 27-31.

[4] Anthony F. C. Wallace, Religion: An Anthropological View (New York: Random House, 1966), pp. 38-39; quoted by Van Rensselaer Potter, Bioethics (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971), p. 84.

increase the order in our environment. This is the thermodynamic imperative, possibly not unworthy to rank alongside the categorical imperative of Kant or even the Golden Rule.[5]

Consume as much entropy as possible, increase the availability of energy for transformation--for the creation of order. Here, once again, is an expression of one of our criteria for determining the degree of goodness of a system--that of efficiency. Of two equally harmonious and comprehensive systems, in which the integrity of parts is preserved, the one which is established and maintained with the most efficient use of energy, that is, with the least entropy or energy down the heat sink, is the better of the two. It is better because it leaves more potential energy available for the creation of further harmonious systems, for the expansion of present systems toward greater comprehensiveness or for the maintenance of present systems for a longer period of time.

With this it seems that my conception of the good humans ought to seek is once again supported. It is good to establish systems or harmonious arrangements of parts in which all parts maintain their individual integrity. It is better to establish more comprehensive systems. It is even better to establish the most comprehensive systems one can in a way that combats entropy by the most efficient use of energy.

Energy and Self-actualization in Pre-industrial Societies

In the context of the good men ought to seek that we have just described and attempted to justify, what does it mean for an individual to fulfill himself? Using the term "self-actualization," which is borrowed from the psychologist Abraham Maslow but not necessarily used in the way he uses it, I suggest that man can actualize himself to attain the good he seeks in three ways: (1) through service so that the social system is maintained and the demands of the ecosystem are met, (2) through individual self-transformation into an altered state of consciousness in which the contradictions found in the world of space and time are resolved in the experienced harmony of all things, and (3) through creative activity that leads either to an imaginative or to an actual alteration of external world systems.

In what follows I also want to show that humans have in fact found fulfillment in these three ways throughout history. Self-actualization has been possible in pre-industrial as well as in industrial societies. This is especially important to realize in a time when many people seem to think that the good life can only be attained by using large amounts of energy.

Pre-industrial societies may be divided into hunting-gathering societies, which live off the land and hence utilize solar energy only insofar as it produces things in their natural state, and agricultural societies, which harness solar energy more efficiently in the production of crops and in animal husbandry.[6] In

[5] R. B. Lindsay, "The Larger Cybernetics," Zygon: Journal of Religion and Science, 6 (June, 1971), pp. 133-134.

[6] Leslie A. White, The Evolution of Culture (New York: McGraw-Hill Book Company, Inc., 1959).

both types of pre-industrial societies individuals find fulfillment or self-actualization through service.

In hunting-gathering societies, organized socially according to kinship and with a simple division of labor between men and women, humans are involved in tasks that provide for the physical sustenance of society and for the protection of society and its members from human enemies. Many of these tasks involve the direct interaction with nature in the procuring of food, fuel, and shelter or the direct confrontation with possible enemies. However, other tasks are attempts to deal with the natural environment and other humans indirectly through the use of religious ritual. Religious ritual is used to intensify the chances of acquiring game, to protect members of society from invading forces that disrupt the lives of individuals or that threaten the security of society as a whole, or to restore equilibrium to nature, society or the individual after disruption occurs.[7] In primitive societies both direct action and religious ritual are used to help maintain the system, and an individual finds fulfillment insofar as he experiences himself serving the system either directly or indirectly so as to contribute to the preservation of the structures that are necessary for the survival of himself and his society.

In agricultural societies that have more effectively harnessed solar energy in the production of food, there is a growth in the density of population and a more comprehensive social system. Some agrarian societies have developed hierarchical social systems with clear-cut distinctions of sexual and class roles, which can be regarded as parts of a more comprehensive system. The integrity of the parts must of course be preserved. An example of this type of society is the caste system of ancient India. To many modern westerners it would seem that such a system would not be one in which an individual could achieve personal self-fulfillment. However, if one of the ways of self-actualization is through service, then it is possible to speak of personal fulfillment through the achievement of excellence in the performance of the roles of the particular class to which a person belongs. The Indian philosopher S. Radhakrishnan makes this point. He does not accept the idea of caste, that one's position in life is determined by genetic and social inheritance but he nonetheless argues that the fourfold class structure of Indian society is democratic, because it insists that all people are equal in that each self "has the right to grow in its own way," because it allows for the kind of individuality that is not "an escape from limitations" but "the willing acceptance of obligations," because it accepts all work as socially useful and as equally important economically, and because it regards social justice not as "a scheme of rights but of opportunities" in a society that "is a pattern or an organism in which different organs play different parts."[8] By fulfilling their roles in society, which are judged to be consistent with their personal potentials and which contribute to the maintenance of the whole complex social order in relation to nature and other societies, individuals were able to actualize themselves through service in stratified, pre-industrial societies.

However, even in hunting and gathering and in agricultural societies, people were

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[7] Cf. Wallace, "The Goals of Ritual," pp. 102-166.

[8] S. Radhakrishnan, Eastern Religions and Western Thought (London: Oxford University Press, 1958), pp. 367-368.

not only interested in maintaining existing systems. While the maintenance of existing patterns of harmony is good, it is not necessarily the greatest good imaginable. Humans have the mental capacity to extrapolate existing order into higher levels of order which are more harmonious, more comprehensive, and in which the integrity of a greater number of parts is preserved. And once this greater good is envisioned human beings seek ways to reach it. They do this through the other two types of self-actualization, both of which involve change. Through self-transformation a human being changes his state of consciousness so that he is able to experience the highest harmony, and through creative activity a human being alters the external world.

In pre-industrial societies self-actualization through self-transformation into an altered state of consciousness seems to have taken place, interestingly enough, through ritual activity. Although ritual probably functioned in such societies to help maintain the social-natural system, as Drs. Eugene d'Aquili and Charles Laughlin, Jr. suggest, the rate of correlation of primitive religious rituals with the finding of game or the production of crops was probably not sufficient to account for the continued use and development of ritual activity. They hypothesize that the universal use of ritual is due in large part to the effect it has on the brain--an effect that transforms human awareness into an experience of a state of harmony that is greater than what one encounters in the experience of the everyday world. In their article, "The Biopsychological Determinants of Religious Ritual Behavior,"[9] d'Aquili and Laughlin show how human religious ritual is associated with systems of ideas that, in the form of myths, pose and intellectually try to resolve the fundamental contradictions of existence, for example, the conflict between good and evil, order and chaos, or the tension between self and the other, the human and the divine. Then, building upon recent work on the human brain, which divides the brain into an energy-expanding or ergotropic system associated with the dominant hemisphere of the brain and an energy-conserving or trophotropic system associated with the non-dominant hemisphere, and which suggests that the two systems alternate in everyday mental activities, d'Aquili and Laughlin cite evidence that if either of the two systems is stimulated sufficiently there is a kind of spillover effect into the other system so that both systems fire simultaneously rather than alternately. This simultaneous firing is experienced as a particular type of altered state of consciousness. When the regular, repetitive, rhymic activity of ritual is participated in for a certain length of time, the ergotropic system is driven to the point where the trophotropic system is fired at the same time. This heightened level of brain function is experienced as a resolution of life's contradictions in a unification of opposites--of order and disorder, of good and evil, of the self and the other, and of the everyday world with the divine. Thus, through ritual the highest harmony can be attained.

In ritual activity this experience is only momentary; there is, however, a way of reaching the same state which is longer lasting. By stimulating the energy-conserving or trophotropic system of the brain through sensory deprivation to the point when the ergotrophic system is fired at the same time, the same oceanic experience is reached. And pre-industrial humans did this through various types

[9] Eugene G. d'Aquili and Charles Laughlin, Jr., "The Biopsychological Determinants of Religious Ritual Behavior," Zygon: Journal of Religion and Science, 10 (March, 1975), pp. 32-58.

of meditation, especially in the more developed, stratified, agricultural societies in which the members of a select group, a priestly class or monastic order, had the time to engage at length in meditative practice. d'Aquili and Laughlin write, "During intense meditative experiences, such as yogic ecstasy and the unio mystica of the Christian tradition, the experience of the union of opposites...is expanded to the experience of the total union of self and other, or, as it is expressed in the Christian tradition, the union of the self with God." [10]

Thus, through ritual and meditation, pre-fossil fuel man was able to actualize himself through self-transformation to experience a harmony of harmonies. Such a transformation of the self is usually judged by religious people to be a greater good than the maintenance of systems on earth, only to be surpassed by a conjectured state of bliss to be realized, if the proper frame of mind is held, after death.

If one accepts my understanding of the good men ought to seek as the creating and maintaining of harmonious systems in which the integrity of parts is preserved, one might ask, is the integrity of part, preserved in the experience of the most comprehensive harmonies attained through ritual and meditation? Some religious traditions, in interpreting the oceanic experience, speak as if the person were, instead of an individual identity, a totally dissolved droplet in the deep sea of the eternal. Because individual identity is correlated with a spatio-temporal order, when the self is no longer experienced as unique but as dissolved in the "All" or the "Void," it is thought that the oceanic experience transcends space and time. This interpretation, however, denies our systems approach to the good men seek, because the idea of harmony of parts in which each part retains its integrity implies a spatio-temporal framework. Therefore, a better interpretation of the experience of unity with the universe, produced through ritual and meditation, is that it is an intuitive taste of the harmony of a grand world system--a harmony that must be further elaborated through careful rational-empirical inquiry so that we can understand how each individual has its proper place in the system and how the system is indeed a harmony of parts. Such an understanding was partly achieved by ancient Taoism and is now being worked out in disciplines such as ecology and systems theory. Self-actualization through self-transformation thus need not be antithetical to scientific understanding; in fact it must be complemented by scientific reason if the integrity of parts is to be preserved and if the good men seek is to be truly understood and realized.

The third type of self-actualization in attaining that which is good, or harmonies of parts, is through creative activity that either actually or imaginatively transforms the external world. Pre-industrial humans, especially in solar powered, agricultural societies, were able to actually alter their environment in a modest way with a technology that cleared and cultivated the land, and that built irrigation systems, in order to harness the sun's energy and grow crops for an expanding population.[11] However, because of the limited supply of energy in comparison with today's society most of the creative transformation of the world probably took place imaginatively through certain intellectual professions and the fine arts. Further, again because of the relatively

[10] Ibid., p. 52.

[11] Mircea Eliade, Cosmos and History (New York: Harper Torchbooks, 1959), pp. 51-62.

limited supply of energy which meant that the majority of people had to spend most of their time working to supply the basic needs of the system, only a few members of society--the aristocratic group of philosophers, mathematicians, dramatists, epic historians, and priests--could achieve self-actualization through their intellectual and artful creations of systems of truth and beauty that heightened and surpassed everyday experience.

Yet, even with the limited supply of energy that allowed only those at the top of stratified societies the time for extensive creative activity, for the masses there was still some opportunity to participate in this type of self-actualization. For ritual, in addition to being regarded as a means of maintaining the natural-social system, in addition to being a way of achieving self-transformation for very limited periods of time, may also be understood as a way of artistic expression. In his home and temple rites the average man could at least participate in artistic activity even if he was not its prime creator, and in the annual festivals that helped to usher in a new year he could also participate in a great cosmic event of the dissolution and recreation of his society and world.[12] It is interesting to ask if our modern, scientific technologies will ever have the comprehensive impact on the lives of people in allowing them to achieve self-fulfillment in the variety of ways that the so-called primitive man's religious ritual enabled him to find the good life.

Energy and Self-actualization in Industrial Societies

In 1750 England began to convert its fuel from charcoal to coal and coke, providing a new source of energy for the First Industrial Revolution. Around 1860 oil and its properties as a fuel became known in Pennsylvania, providing a new form of fossil fuel to combine with new developments in science and technology that inaugurated the Second Industrial Revolution at the beginning of the twentieth century. With this new energy source the third type of self-actualization, through creative activity that actually transforms the world has become more of a possibility for finding the good life for more people than ever before in history. A new elite of scientists, industrialists, technologists, businessmen, and politicians has combined to effect major transformations of the world and thus create more comprehensive material and social systems. The result has been a vast, worldwide transportation network of cars, buses, trucks, ships, trains, and planes--fueled with petroleum products; artificial environments to make people more comfortable and to protect sensitive equipment such as computers--driven by electricity produced by fossil fuels; a food production process that feeds hundreds of millions of people, farm machinery, pesticides, processing plants, supermarkets, and a transportation system that links these together--all based on oil.

Most people today would regard all this as good, as progress. In terms of the conception of the good as systems or harmonious relations of parts, the creation of more structure as a result of an increase in energy is a good thing. With more energy we have been able to create more complex systems of society in relation to nature than ever before. If the comprehensiveness of a system is a criterion of its worth, we have indeed progressed toward greater good.

Furthermore, the new creations of fossil fuel technology have provided an opportunity for greater numbers of people than in pre-industrial societies to engage in self-actualization through creative activity that imaginatively transforms

[12] B. F. Skinner, Walden Two (New York: The Macmillan Company, 1972).

the world. As the jobs that provide the basic necessities of life are taken over by machines, and as humans still work to help maintain the system but now as the managers of machines, people are freed from the tiring, time-consuming, back-breaking toil of pre-industrial man, to have time, if they so desire, for intellectual and artistic activity. The opportunity to find fulfillment in this way is no longer open to an aristocratic few but is now a possibility for the thousands of people going to evening classes in education, to art studios, to photography clubs, to craft courses, and to lectures and discussion groups.

However, although more people than ever before are actualizing themselves by creatively transforming the world, most of us still find ourselves not as the creators of new complex systems of industrial societies but as servants maintaining systems created by others. While the maintenance activity of society is not just physical as it tended to be in earlier societies, self-actualization through service is still probably the dominant way in which most people reach for the good. Even though in their spare time they may have some opportunity for intellectual and artistic creativity, people such as the coal miner, the automobile assembly line worker, the third grade school teacher, and the family counselor are all working to keep the systems created in industrialization and fueled by fossil energy going. We are servants of the system.

Even though one finds self-actualization through service in industrial as well as in pre-industrial societies, there do seem to be two important differences, both of which are attributable to the increase in available energy and the corresponding increase in the comprehensiveness of systems.

First, in industrial societies there is an increase in the possibility of individual freedom over pre-industrial societies. In the more comprehensive social systems that have resulted from the addition of fossil fuel energy to solar energy there is a greater variety and number of roles that people can play as parts of the system. In contrast to the rather limited number of relatively fixed vocational roles in hunting-gathering and agricultural societies, today a child growing up has a numerous set of vocations from which he can choose. Thus, a young person today has a greater chance of fulfilling his own unique potentials than a young person in ancient Hindu society, where only a very limited number of options were present and which options a person actualized were largely determined by birth.

Besides having a greater number of choices, some people in industrial societies have more power to actualize the choices they make as to how they serve the system. In pre-industrial societies most men, women, and perhaps even children were limited to the tasks necessary to meet the basic physical needs of the system; the dominant occupations were the obtaining and processing of food and the protection of the system from outside invaders. Even if one did conceive of a different possible option for a life vocation (and it is questionable whether this was even possible), the demands of the system limited the individual's power to act on his dream. However, as fossil fuel technology developed to the point of replacing human and animal power in the meeting of basic needs, people have become freer not only to envision new vocational possibilities but also to act on them. Most affected by this have been women and children. Labor saving devices in the home have liberated women from domestic maintenance activities so that, if they wish, they can have a career and serve the system in a way more acceptable to their own personal desires and abilities. Modern technology has also freed children from manual labor on farms and in family businesses and has given them more time for education. This has permitted since the late 1800's the development of the educational system so that in fossil-fuel societies,

college and university education occurs on a very large scale. The utilization of fossil fuels in modern technology has thus created more comprehensive social systems and through these has given people more choices and also greater opportunity to fulfill their choices.

The second significant difference between industrial and pre-industrial societies regarding self-actualization through service is not as positive as the first. As systems fueled with additional energy become more comprehensive, with a greater number and variety of interconnecting parts, it becomes more difficult for the individual to perceive the significance of his place in the system. While he still is spending much of his life working within the system and for the system, even though without his effort the system is so large and complex he begins to feel that what he does really makes little difference. And if he cannot perceive how the fruits of his labor actually support the system he is serving, he may even experience a sense of lostness, of alienation, and of meaninglessness. While service is still a part of our lives, it is more difficult in industrial than in pre-industrial societies to see the significance of our service; many have even come to think that service is not a legitimate way of achieving self-actualization. Rather than being self-fulfilling, service has become a necessity in order to meet our own basic needs, and we look elsewhere than to our primary vocation for ways to realize the good life.

If we look back to my original proposal concerning the good that people ought to seek, I think we can understand what has happened and why the sense of lostness, of alienation, and of meaninglessness, which pervades our modern industrial states, may be an indicator that something has gone wrong and that too much energy may not be a good thing. You will remember that the good was defined as systems or harmonies in which the integrity of each of the parts was preserved, and that it was suggested that a more comprehensive and efficient system was better than a less comprehensive and efficient one, as long as the harmony and integrity of parts was preserved. What has happened, I think, as a result of increased energy is the development of more comprehensive systems that are still harmonious, but in which the parts--in this case self-conscious human beings--are no longer able to maintain their integrity. From his point of view the individual no longer is able to see himself as essential to the functioning of the social system (even though he is when his situation is looked at objectively). Thus, he regards himself as lost and isolated, and his life seems meaningless.

The sense of being lost in the system and the resulting impossibility of finding fulfillment through service in a modern industrial state may be contributing factors to many people, especially the young, turning away from society. In some instances they have tried to find social systems that are limited in comprehensiveness and are isolated from the main social system. The attempted return to agriculturally based communes is an example of this, and B. F. Skinner's Walden Two is a utopian vision of a more limited social system in which self-actualization through service and creative activity is possible.[13] In other instances many have turned inward in an attempt to find harmony through self-transformation into an altered state of consciousness by employing the techniques of Yoga or Zen, or through the use of mind-expanding drugs. And one might expect that these trends will continue to exist among those who are aware of their own sense of meaninglessness and who see this as partly a result of the bigness of the industrial state, which in turn is the result of the use of fossil fuels to supplement the energy from the sun.

[13] Ibid.

Many people today are concerned, legitimately so, about the projected fact that we will run out of fossil fuels in the not too distant future. To people so concerned what I have said should be of some comfort, because I have tried to show that self-actualization in all three ways is possible in pre-industrial as well as industrial societies. The good life will still be possible in the future even if our energy reserves are depleted and we do not develop viable alternative sources; it will still be possible even if we have to return to a modified agrarian system.

I have also tried to indicate that we should not only be concerned with the depletion of energy but also that we may have a problem with too much energy, because, although increased energy has given us greater freedom over pre-industrial man, it has also led to the demise in the minds of many humans of achieving self-actualization through meaningful service. If we do discover alternative sources of energy to fossil fuels in the years ahead, and if these new sources turn out to be unlimited, my concern may become a real danger. It will become a serious question whether or not too much energy might be a bad thing. Even if through technological creation we achieve a breakthrough that leads to unlimited energy for mankind, we may still wish to control the flow of that energy. In particular we should be concerned with decentralizing our huge social systems so that individual humans can regain a sense of their own integrity as a significant part of society and once again find fulfillment through service. And then, with the energy available people could also realize the good through creative activity in intellectual endeavors and in the fine arts, and through personal self-transformation into a state in which the harmony of all systems may be experienced. If all this occurs it may still be possible to reach a state of human civilization in which the greatest possible good is realized on earth.

HOW YOUNG CHILDREN VIEW THEIR WORLD: THE ASSESSMENT AND THE IMPLICATIONS FOR EE

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Introduction

Today's environmental education (EE) has come a long way from the days of W. L. Jackman's Nature Study Program. Its interdisciplinary, holistic focus on problem-solving and decision-making (Stapp, 1969; U. S. Office of Education, 1973) includes both conceptual and affective domains (Horvat, 1974a). In fact, many researchers (Naylon, 1970; Swan, 1971; Voelker, 1973) have stressed the important role attitudes, values and beliefs -- the affective domain -- play in environmental decision-making.

There seems to be no lack of reports assessing knowledge and/or opinions regarding environment-related problems (Barnett, 1970; Chaney, 1970; Constantini and Hanf, 1972; Hine and Gerlach, 1970; Mitchell and Lunneborg, 1973; see also Voelker, Heal and Horvat, 1973). But the vast majority of populations in these studies were high school or college students or adults. As Knapp (1972) points out, few studies have examined the attitudes of elementary and junior high students toward their environment. Knowing how these children view their world would allow more effective EE planning for the critically-important younger students.

The Problem

This ongoing research* program seeks to understand elementary and junior high students' orientations towards the environment and environmental problems. For our purposes, we define the responses on the measurement instruments developed as ENVIRONMENTAL ORIENTATIONS.

> ENVIRONMENTAL ORIENTATIONS--(EOs). The expressed responses of individuals to both general and specific aspects of their environment. EOs reflect both cognitive and affective input involved in environmental decisions. (Horvat, 1974b, p. 10)

Three instruments, collectively titled the ENVIRONMENTAL ORIENTATIONS INVENTORY, were developed. Each instrument focused on one area of orientation:

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A. ENVIRONMENTAL ORIENTATIONS ...ard the present and future (general feelings of optimism or pes...mism toward "the world of today" and "the world of tomorrow") measured on two, ten-item semantic differential scales (modified from scales originally developed by Burchett, 1971). This instrument, titled the "World of Today/ Tomorrow", required students to express their feelings simply by checking one position on a five-point scale for each pair of adjectives. For example:

OUR WORLD OF TODAY

Ugly____:____:____:____:____ Pretty

Clean____:____:____:____:____ Dirty

The same adjectives were used on the "Our World of Tomorrow" scale.[1]

B. ENVIRONMENTAL ORIENTATIONS toward general and specific aspects of the environment and pollution, measured on a twenty-seven item Likert format instrument. This instrument, titled "Some Ideas I Have", allowed students to express their agreement or disagreement with items along a five-point scale. Items included:

- Soon there may be too many people living on the earth.
- Don't waste the best T. V. time with programs about pollution.
- Use a lot of weed-killer in your garden, so you won't have so many weeds to pull.

Development procedures favored items that would attract a wide diversity of response, and be scorable on a scale of "environmental responsibility" (determined by a validity panel).[2]

C. ENVIRONMENTAL ORIENTATIONS toward specific environmental problems, contained in an illustrated ten-story format, followed by various "solutions" to these problems. The stories, collectively called "Stories About Real Life Problems", were on:

Wilderness Use	Strip Mining
Air Pollution	Clear-cutting
Water Pollution	Overpopulation
Solid Waste/Recycling	Land Use

Each story was open-ended and developed through procedures designed to make them usable with elementary and junior high students. No story required reading ability higher than Grade 4 (Fry, 1968). The solutions to solve these open-ended problems were empirically derived from suggestions of children, both in structured interviews and written formats.

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[1] "Measuring Upper Elementary Students' Environmental Orientation Toward The Present and Future", a report detailing development of the sematic differential, is available upon request from the author.

[2] Development of this Likert scale is discussed in Horvat and Voelker, 1976.

- Content analysis aided the establishment of categories for the solutions children proposed.[3]

Collectively, this three-instrument battery provides information across a range of environmental orientations -- from specific solutions preferred to specific problems, to the general optimism/pessimism that children express for their world.

While developing this affectively-focused instrument battery for upper elementary and junior high school students, we included multiple validity and reliability checks. Following pilot testing, the final field test of the revised instruments in the battery was conducted with 665 fifth and eighth grade students in four Wisconsin communities. Details of statistical analyses of data and instrument development/revision are contained in Horvat (1974b). We will replicate the study during the fall of 1977, using school populations drawn from western New York and northern Illinois.

Factor analysis of field test responses on the three-instrument inventory helped identify the following orientations, which represent scales of items within the three instruments:

The world of work today[4]
The world of work tomorrow[4]

Scales from "Some Ideas" ←
- use/abuse of nature
- overpopulation/population control
- general environmental concern
- eco-responsible behavior

Scales from "Stories About Problems" ←
- personal concern
- eco-insensitivity
- environmental protection
- technology
- action towards nature

Here is an example of an item included on each of the above factors:

1. Scales of Orientations to general problems in the environment (from "Some Ideas"):

use/abuse of nature	"If my dad owned a marsh or woods where some animals lived, I would like part of it made into a playground (like at school)."
overpopulation/ population control	"From now on, people getting married should have no more than two children."
general environmental concern	"I worry about the environment (problems like pollution)."

[3] The initial stages of developing "Stores About Real Life Problems" are described in Voelker and Horvat, 1976.

[4] All ten items loaded on the same factor; i.e., the semantic differential scale was uni-factorial.

eco-responsible behavior	"Soda pop should be sold in bottles that can be used again, not in cans."

2. Scales of Orientations toward solutions to specific problems (from "Stories About Real Life Problems"):

personal concern	"The best way to solve the problem is for Jo Lynn's family to move away, or her mother get another job." (A "solution" which ignores the environmental problem to which the story refers, but solves the problem for the family.)
eco-insensitivity	"Keep the factory open. Jobs are more important than a little air pollution."
environmental protection	"Stop all the strip mining. It ruins the land. Use tunnel mines instead."
technology	"Put a filter on the chimney to stop the smoke."
action towards nature	"Cut the tree down before someone gets hurt."

We used the independent variables of Grades (5 and 8), I.Q. (low, medium, high), Socioeconomic Status (low, medium, high, based on father's occupation ranked according to the North-Hatt, 1974, scale), Community (urban, suburban, rural), and Sex (nested within grade). The dependent variables were scores on the various EO scales. Using a multifactorial Analysis of Variance (ANOVA) procedure, we "compared" scores on these scales, arranged by the independent variables, to gain an understanding of elementary school children's environmental orientations. When the ANOVAs indicated significant main effects or interactions, Scheffe post hoc comparisons were used to pinpoint differences (details in Horvat, 1974b).

Discussion of Results

To date, we have learned the following about young children's environmental orientations:

1. Orientations towards the present and future (World of Today, World of Tomorrow) appear most stable. Other orientations towards environmental problems in general, or specific solutions, are less stable (but do exceed .70, test-retest correlation). Possibly, orientations toward the present and future are the result of a frame of reference developed over a considerable period of time, reflecting an individual's self-image and other psychological factors.

2. Orientations of eighth graders are more internally consistent (Hoyt reliability) and stable than those of fifth graders. Age and experience perhaps are factors here. Regardless of observed differences, however, the inventory provides a reliable measure even for younger fifth graders.

3. None of the independent variables of Grade, Sex, I.Q., Socioeconomic Status (SES), or Community are always significant on Environmental

Orientations in this study. While I.Q. and Grade appear as significant effects most frequently, the other variables are also useful in understanding Environmental Orientations.

4. Education appears to be a strong factor in producing a more positive environmental concern. Our results show that grade level (reflecting educational differences) was frequently significant across many Environmental Orientations. Younger children seem more optimistic toward the future, while older children are generally more environmentally responsible. For example, eighth graders scored significantly higher, as a group, than fifth graders on the total Environmental Orientation toward "pollution and the environment" (comprising all the items on the Likert instrument). In terms of several desirable Environmental Orientations such as lack of selfish or personal concern and favorable orientation towards population control, eighth graders once again were significantly higher scorers. It is reasonable to account for this difference partly on the difference in educational levels. Of course other factors, such as maturation, experience, etc., also enter in.

5. Socioeconomic status is a significant main effect only on the total Orientation (Likert instrument) and the Personal Concern Orientation. Our results agree with other researchers: Higher SES respondents show more environmental concern than lower SES respondents, although SES does not appear to be a pervasive effect.

6. I.Q. was a very pervasive main effect. Invariably, on scales where I.Q. was significant, the high I.Q. group gave responses which showed a greater concern or awareness for environmental problems than their lower I.Q. counterparts.

The Big Picture

Finally, we used the observed significant main effects on the various Environmental Orientations included in this study to produce a "generalized picture" of the participating students' orientations towards the environment and environmental problems. Scores on some EOs were judged by a panel for "environmental responsibility", so we could say a higher score on a certain EO represented a greater "degree" of environmental responsibility. (The generalizability of this "picture" should be evident from results of the replication planned for the fall of 1977.)

Fifth graders are invariably more optimistic than eighth graders toward the future, but are also less environmentally responsible. The fifth grader tends to see specific environmental problems in the context of how they affect him and his family. The actions he suggests are often directed at solving the problem for the family rather than solving the problem at large. He is not afraid to take a stand for or against a technique causing environmental problems, but more-or-less shuns middle ground compromises to such problems. One of his prime concerns in environmental protection is saving animals' homes and an appreciation of the aesthetic values of nature. Eighth graders generally take the opposite approach in these areas. This view of fifth versus eighth graders' ORIENTATIONS parallels the children's development from "I" to "we" modes of thinking, gradually including more "outside" factors when considering environmental problems.

Children living in rural areas seem to differ in several respects from children in suburban or urban communities. The rural children are considerably more optimistic toward the relationship of man and nature (along with suburban children) than their urban counterparts. This might best be described as a greater innate feel for the "natural order of things" -- perhaps of ecological balance -- although most school children of this age would not know what those exact words meant. The rural children also have a lower regard for technology as an environmental problem-solver than suburban children. All children, however, are highly in favor of such solutions -- rural children just a little less so.

Overpopulation problems stand out from the other EOs. I.Q. is not a factor in observed differences here. While older children are more environmentally responsible than younger children, differences in EO on the basis of sex show up. Eighth grade girls refuse to acknowledge overpopulation as a problem, or that any means which might limit personal freedom should be employed in this area. The boys are more willing to concede these points. Group means on the two population-based EOs, in addition, show the total group -- both girls and boys -- is less environmentally responsible in this area than any other included in the study. Since children's degree of involvement is a function of their everyday lives, the "abstract" concept of population for young children might not be relevant -- hence, the lower EO scores.

Children generally agree on just what the most important environmental problem is: air pollution. Only SES was a significant effect here. The differences in perceptions of the most important problem according to SES groups clearly provides example of elitism in the environmental arena. The high SES children are more concerned with preserving wilderness and population control -- the low SES children more concerned with the immediate problems of noise and water pollution,

Implications

There are several implications drawn from the results of this study. First of all, the schools can play a role in fostering environmental responsibility. Since older children already score better in this regard than younger children, we might presume schools are already doing this. However, the environmental message may be "getting through" in many ways other than formal educational channels (thus accounting for frequent significant grade effects).

Curricula for younger children should enable the children to see beyond their own personal concerns to how environmental protection will affect other people. Such curricula could also build on the inherent optimism fifth graders exhibited in this study toward the future. Since younger children also evidence a greater concern for themselves and their families than eighth graders, this concern might serve as a useful entry point for an EE unit at this level, but from this initial starting point the scope should be widened.

Technology seemed a favorite problem-solver for both fifth and eighth graders in this study. As environmental educators, we must help children understand technology's limitations -- and other approaches to solving problems. This may lead into dealing with human value questions beyond themselves -- which can be dealt with at upper elementary and junior high levels.[5]

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[5] All teachers are urged to read the seminal essay by Garrett Hardin, "The Tradegy of the Commons", Science 162:1243-48, 1968, which describes the important class of environmental problems which has no technical solutions.

The children in this study did not recognize the role of population in environmental problems. They identified effects of more people and increased affluence as the most important problems, rather than naming the root causes of the all-too-visible effects of air and water pollution. (This agrees with Viederman's 1973 study of high school students.) Schools can play a vital role in the area of population education. From our results, this appears currently lacking.

The schools might also foster some community action programs involving students. These programs would help change orientations of the number of students we found who did not recognize or think they could do anything about local environmental problems.

Finally, methods need to particularly be developed to reach the low SES, low I.Q., child who does not recognize the existence or importance of an environmental crisis. In the coming years, the environment will require more than its present affluent "WASP" support. The schools can help build a much needed broader support base.

In conclusion, we found it possible to develop affectively-focused instruments to assess "environmental orientations" with acceptable validity and reliability, and usable with upper elementary and junior high students -- provided input from children is used at every step.

In terms of the results obtained so far, our schools certainly have a challenge; to encourage a more positive orientation toward environmental problems, including overpopulation. Children must learn they can play some role in helping solve some environmental problems, the actions that can be taken, and that such problems are not the exclusive property of big cities like New York or Chicago. If, as educators, we can help children gain in environmental responsibility, we will be laying the foundation for a broad-based coalition of environmentally-concerned citizens, cutting across class and economic lines, and capable of preserving and protecting this planet for those who follow.

REFERENCES

Barnett, Larry. 1970. "Concern with Environmental Deterioration and Attitudes Toward Population Limitation," BioScience 20 (18): 999-1003.

Burchett, Betty. 1970. "A Descriptive Study of Fourth, Fifth and Sixth Grade Students' Attitudes Relative to Environmental Problems," unpublished Ed.D. thesis, Indiana University, Bloomington.

Chaney, Edward. 1970. "The Environment: Who Cares? Why? So What?." Journal of Environmental Education 1 (3): 80-82.

Constantini, E., and K. Hanf. 1972. "Environmental Concern and Lake Tahoe: A Study of Elite Perceptions, Backgrounds and Attitudes," Environment and Behavior 4 (2): 209-242.

Fry, Edward. 1968. "A Readability Formula that Saves Time," Journal of Reading, April, 1968: 513ff.

Hardin, Garrett. 1968. "The Tragedy of the Commons," Science 162: 1243-1248.

Hine, Virginia and Luther P. Gerlach. 1970. "Many Concerned, Few Committed," Natural History LXXIX (10): 16ff.

Horvat, Robert E. 1974a. "Development of Environmental Education in the Schools: Towards a Value-Based Focus," Counseling and Values 18 (4): 248-251.

Horvat, Robert. 1974b. "Fifth and Eighth Grade Students' Orientations Toward the Environment and Environmental Problems," Ph.D. thesis, University of Wisconsin, Madison (order #74-10, 248 from University Microfilms, Ann Arbor, Michigan).

Horvat, Robert E. and Alan M. Voelker. 1976. "Using a Likert Scale to Measure 'Environmental Responsibility'," Journal of Environmental Education 8 (1): 36-47, Fall, 1976.

Knapp, Clifford. 1972. "Attitudes and Values in Environmental Education," Journal of Environmental Education 1 (3): 65-74.

Mitchell, Sandra and Patricia Lunneborg. 1973. "Effects of Environmental Education on First Graders," Journal of Environmental Education 4 (4): 34-37.

Naylon, Michael. 1970. "Needed: A 'Real World' Program of Environmental Education," American Biology Teacher 32 (7): 404-409.

North, Cecil C. and Paul K. Hatt. 1947. "Jobs and Occupations: A Popular Evaluation," Public Opinion News 9: 3-13.

Stapp, William. 1969. "The Concept of Environmental Education," Journal of Environmental Education 1 (1): 30-31.

Swan, James. 1971. "Environmental Education: One Approach to Resolving the Environmental Crisis," Environment and Behavior 3 (3): 223-229.

Tognacci, Louis, et al. 1972. "Environmental Quality: How Universal is Public Concern?," Environment and Behavior 4 (1): 73-86.

U. S. Office of Education. 1973. Environmental Education Handbook, U. S. Government Printing Office, Washington.

Viederman, Stephen. 1973. "Needed Research in Population Education," Journal of Environmental Education 4 (4): 51-55.

Voelker, Alan. 1973. "Guidelines for Environmental Education Curriculum Development" in Environmental Education: Planning Priorities, ed. Alan Voelker and Robert Horvat, University of Wisconsin Extension, Madison.

Voelker, Alan M., Fred Heal and Robert E. Horvat. 1973. An Annotated Bibliography of Environmental Education-Related Research: 1969-1972. Center for Environmental Communications and Education Studies (CECES) Report, University of Wisconsin, 410 N. Murray, Madison 53706 (Available on request to CECES).

Voelker, Alan M. and Robert E. Horvat. 1974. The Development of an Instrument for Determining the Nature of Elementary School Children's Environmental Decisions. Final Report, Project 2-E-026. U. S. Office of Education, DHEW, Washington.

Voelker, Alan M. and Robert E. Horvat. 1976. "Elementary School Children's Views on Solving Selected Environmental Problems," Science Education 60 (3): 353-361.

"WHEN THE EARTH DIES, WHERE DO WE BURY IT?": THE NEED FOR COMPREHENSIVE ENVIRONMENTAL MONITORING INDICES

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The purpose of this article is to consider some alternatives to the problem, "When the Earth dies, where do we bury it?" More specifically, I am proposing a means by which policy-makers and the public can assess more effectively the likely consequences of policy decisions regarding the use and protection of the environment. Clearer choices regarding what we can and cannot afford would be possible if we had an environmental quality index by which to monitor environmental change and the chances for successful human response to it, and an index which could be used to assess the relative cost of restoring the environment to established standards of quality. Persons interested in conservation could play a critical part in helping such indices become guides for public policy and evaluation of the administrative effectiveness of environmental agencies at all levels of a government.

The most (?) constraining factor on the quality and quantity of life in the next twenty-five years may well be a cumulatively deteriorating environment. The fact is, we do not know whether or not this will be the case. Even more alarming is the fact that our approach collectively to finding out is better described by an analogy of a creeping infant than a sprinter racing against the clock. Should we resign ourselves to an increasing probability of major environmental, and hence cultural, collapse within the coming quarter century?

Our heritage includes some emphatic responses to this question. Among these is the proclamation by President Theodore Roosevelt who prescribed an environmentally conscious ethic:

> I recognize the right and duty of this generation to develop and use our natural resources; BUT I DO NOT RECOGNIZE THE RIGHT TO WASTE THEM, OR TO ROB BY WASTEFUL USE, THE GENERATIONS THAT COME AFTER US. (Emphasis added.)

In an article entitled, "Running Out of Everything," Sidney Lens reviews the increasingly familiar litany of shortages and human pathologies plaguing us. He suggests that with accurate information on the supply of resources and the patterns of their use we can begin the managed reduction in living standards that is apparently a necessary alternative to major unmanaged depressions. In his recent assessment of world facts and trends, John McHale forthrightly states:

> Our minimal assertion suggests that we accept some of the evidence as strongly indicative that WE ARE INDEED APPROACHING THE MOST CRITICAL JUNCTION IN HUMAN AFFAIRS IN ALL HISTORY. (Emphasis added.)

Are these opinions of alarmists who would deflect us from "business as usual" for some ulterior motive? While we can cite progress made in a number of critical environmental areas, we may yet be losing ground overall. In a news article entitled, "Lung Disease Deaths Mount," the National Center for Health Statistics reports that in 1973, 41,042 people died from major lung disease, EXCLUDING CANCER,--an all-time annual high. Chronic lung disease (including asthma, bronchitis, and emphysema), the tenth leading cause of death in 1969, moved to sixth on the list of national killers in 1973. Between 1955 and 1973, emphysema alone increased roughly tenfold. Many factors in complex interaction may account for this movement, but air quality was certainly not a neutral or retarding factor in the incidence of lung disease. However, according to the Council on Environmental Quality (CEQ), U. S. air quality is better today than it was in 1970. It has also been estimated that about 80 percent of water pollution in industrial nations today has been generated in the past quarter century. At these rates, what are our prospects for an environment hospitable to human life at the end of the next twenty-five years?

What avenues of effective response are open to us to increase national concern and action to maintain or restore environmental quality during the next twenty-five years? It is my contention that the principal obstacles before us are (and will continue to be) less technological and economic than political and educational. Persons reading this are more aware than the average world citizen of our global potential, via environmental depletion, to short-circuit human evolution. But are we sufficiently sensitive to emerging subtle environmental changes that may precipitate major collapse? Small scale processes, apparently insignificant in today's context, may well be the major limiting conditions of future environments. For example, a mere half degree decline in average yearly temperature in certain regions of Europe has been shown to be associated with a shortening in the duration of the agricultural growing season by a factor of weeks. Hence, ever greater sensitivity to monitoring and describing even subtle social and physical environmental changes and considerable caution when considering implementation of a technological change of unknown or potentially harmful consequences (e.g., floating off-shore nuclear power plants) are clearly warranted. For such sensitivity and caution to be politically feasible under current, though changing, political ground rules, the public must be mobilized and informed of the state of the environment.

What then are the steps necessary to operationalize effectively the environmental ethic articulated by men such as Theodore Roosevelt and Aldo Leopold? What is needed is an index which summarizes and publicizes the state of the environment, and one that communicates the probable costs of what must be done to maintain or restore the environment. For such indices to be fully effective, they would have to be on a par with GNP in their ability to excite political imagination. Americans have generally accepted the concept of GNP as a valid measure of national economic well-being. Fluctuations in GNP, or more usually a decline in a rising rate of growth, have often generated a critical mass of public support for rather dramatic and radical policy changes; for example, regarding the appropriateness of government as the "employer of last resort." In this regard the GNP symbol has had an educational effect of sorts on the American public. While few Americans understand the technical details of GNP index construction, many react politically to changes in its levels, and especially to its course and general direction over a period of years. Thus, while technical construction of environmental monitoring indices would also be complex, the comprehensive summary measures could be meaningful to and readily comprehensible by the general public.

There are numerous existing examples of measures of the quality of various components of the physical and social environment. The Council on Environmental Quality publishes an annual report with a variety of indices of environmental quality. John McHale's World Facts and Trends (Second Edition) is selective, but highly useful. Efforts by HEW (Toward A Social Report) is another exercise in this direction. W. A. Thomas has edited a volume called Indicators of Environmental Quality, to cite another such effort. Herbert Inhaker's recent volume, Environmental Indices, provides a very readable summary of developments and problems in monitoring. But, having numerous fragmented measures is not enough. It would be difficult to attain consensus on which of the existing indices is most valid, since validity depends in part upon propcsed uses. Nevertheless, comprehensive environmental monitoring indices could be developed with the proper support for research and experimental application. National experience with GNP and other economic indicators could guide the evaluation and use of such indices.

Two such environment indices proposed here are EMI (Environmental Monitoring Index) and ERCI (Environmental Reconstruction Cost Index). EMI is simply defined as a comprehensive quantitative measure which aggregates and summarizes available data on environmental quality. ERCI is defined as the estimated annual dollar (or energy) cost of meeting all social and physical environmental standards established by government, expressed as a ratio to GNP. It would include both private and public estimated expenditures. Hence, if the ERCI value were .5 for a given year, to meet environmental standards at that time would require an expenditure equal to one-half of GNP. Considering this index in series would give additional information. For example, if ERCI is .5 at year X, and projected to be .6 at X + 1, .9 at X + 2, and 1.5 at X + 5 (assuming that actual environmental expenditures in previous years were at a rate of say 50 percent of ERCI), we might be more inclined as a nation to increase the percentage of ERCI funded in year X. Hence, ERCI would enable us to decide how long we wish to postpone effective action in response to environmental contamination, knowing how costs (hence, taxes) would be accelerated in future years by such a delay. It would give the public a standard against which to assess statements about what we can and cannot afford to do at a given time, for example, meeting established air or water quality standards. If we realize that by refusing to spend $100 million today on an environmental problem, we will be required to spend three times that amount in five years to meet the same standards, or ten times as much if we wait ten years, then chances are that we will make more responsible national policy decisions in the next twenty-five years than we have in the past twenty-five years. That is, with valid information and accurate anticipation of probable consequences, the public can be expected to support the necessary, though difficult, decisions regarding environmental quality in the coming quarter century.

There are several problems associated with the development of any comprehensive index such as EMI. One is that information on a significant decline in one critical component of environmental quality, such as the quality of water used for human consumption, might be masked in the overall summary index by improved performance in other environmental areas of relatively lesser import, such as expanded parks and recreation facilities. This is a problem involving weighting and to some extent values. Any single comprehensive index would have to be anchored in an arbitrarily selected value standard, such as the impact of environmental change on human health, or on productive employment, or on aesthetic values, or on the probability of long-term sustained productivity of the environmental

region being indexed. If, for example, we chose human health as a priority standard, then continuing the comparison above, the quality of water for human consumption can probably be demonstrated to be of more critical value than the expansion of parks and recreational facilities. The reverse might be the case if we were to select aesthetic values as being a higher priority standard. To make matters even more complex, while we may be able to rank environmental changes in order of importance with regard to any specific standard, it would be difficult to determine how much more important one change may be than the other. Hence, one problem in the development of an EMI is the establishment of the value standards against which changes in environmental quality could be relatively assessed. One way to handle this apparent dilemma is to develop several comprehensive indices, each anchored in a different major value standard. In the political process, the public would then be free to respond to the performance of the index which they deemed most important, knowing what the comparative performance of the other indices would be in relation to the value standard they chose to give priority to. Hence, if one wishes to encourage environmental changes which maximize productive employment, one can see how these changes affect an index based on maximizing human health, or maximizing the future productivity of the environment of a given region.

In addition to the high visibility of the overall summary EMI, component subcategories such as the quality of water for human consumption could also be made highly visible. Hence, those persons or groups particularly interested in a single component's performance could continue to have ready access to such data. Such single category indices are generally what is available now in the way of environmental monitoring data. As only a "part of the story," they tend not to have the clout of a comprehensive index such as GNP, since it is commonly assumed that we do not have all the relevant information on other important variables which may justify any negative changes in the single category index. For example, for some persons or groups, the lowering of water quality may be offset by an enhanced transportation network which might result in a net energy savings. A set of comprehensive EMI's based on various value standards, could help the public make more informed decisions on the desirability of such tradeoffs. Although we may be interested in agricultural productivity, or productivity in the manufacturing sector independently of GNP performance, we seem to be more politically responsive to changes in GNP, the comprehensive measure of economic output. Hence, the expectation exists that a comprehensive EMI would be a valuable tool in alerting and mobilizing the public to changes in environmental quality.

Another major problem with a comprehensive EMI is how to put together component performances which are commonly expressed in quite different units, such as acres of land removed from agricultural use, numbers of species added to, or removed from, endangered species lists, degree of eutrophication of bodies of water, etc. This seems almost insurmountable, and has probably been one of the more serious obstacles to development of comprehensive EMI's to date. There are several recent developments which can help here, and each should be fully researched and developed to its maximum as a tool for use in constructing EMI's. One is the growing body of work in converting or assessing the dollar value of various natural resources, alternative land use patterns, and human environment components. Another technique is based in the assessment of the productivity of natural areas, expressed in terms of energetics, the energy accounting technique being developed by Odum and others at the University of Florida. Perhaps each component in an EMI could be converted into the energy requirement necessary to sustain one human life for one year expressed in solar calories. For example,

a given water source can sustain so many humans for a year, but in so doing requires a certain amount of energy, some natural and some humanly applied to it. If the quality of that water source were to be lowered by a decision to use it more rapidly (for example, through encouraging the population growth of the area using that water supply), or to introduce industrial or municipal effluents into it, then the source would be capable of sustaining fewer persons than it previously did, hence increasing the per capita energy cost of providing water, or would require the addition of considerably more energy to maintain its availability to the same number of persons through some form of water treatment (e.g., chlorination, aeration, filtration). Thus, the energy required to sustain a person per year would rise (as would local taxes and/or utility costs).

In a similar way, the ERCI identified above could also be calculated in terms of energy costs as an alternative means of expression to dollars. As energy becomes an increasingly important factor in economic decisions, it would be useful to be aware of the energy requirement to meet specified standards of environment quality in various categories such as water quality.

It is not within the purview of this article to explore the comparative advantages or even the applicability of such techniques in detail, but rather to simply point out that technical developments are occurring which could facilitate the development and application of comprehensive EMI's. Visible public support for the research and development of such tools is necessary if they are to have a role in the important public policy debates on environmental quality which will be a hallmark of the coming decades of American politics. Such tools would be of as much use to the business community as they would be to the environmental movement. They would enable us to clarify value differences and trade-offs, and in certain instances to make allies of those who now perceive their interests to be in conflict.

There is an option that may be attractive to some policy-makers; namely, to continue to alter (meaning, lower) standards of environmental quality. At this point the EMI measure becomes a useful check on such an option. Once the public realizes that environmental contamination is not randomly or equitably distributed onto the population, but rather is concentrated on those least able to resist, the poor and politically weak and future generations, they may well be more amenable to political mobilization in defense of their present and future.

Is it naive to assume that we are capable of an about-face in national priorities, including development and use of comprehensive environmental monitoring indices and indices of environmental reconstruction costs? Several changes have occurred and are occurring which support the process of reordering priorities. Industrial nations, especially the U. S. A., historically have had several "escape routes" which have served to immunize policy-makers and other more privileged citizens from many of the consequences of environmental deterioration. Large inequities in personal wealth and the resulting opportunities for geographic mobility ("If things get any worse, I'll move someplace else") and multiple residences (the country home or vacation cottage), access to technologies (e.g., home air purifiers, air conditioning, bottled water for drinking, etc.), and the ability to purchase preventive health care, all help ameliorate the negative effects of environmental contamination. However, the developing political ground swell for greater social and economic equality in America and impending limitations on affordable energy may well limit the extent of immunization traditionally enjoyed by privileged groups.

Other escape routes have included a belief in the unlimited ability of the natural environment to absorb and process pollutants and regenerate itself. However, due to cumulative interactive effects, a critical threshold may have been (again, we just do not know for sure) or may be about to be surpassed such that avoidance of environmental contamination may be increasingly difficult for even the most affluent among us. Then, following a "triage" model, we may well assign a land area, river, lake, or inner city to the "unreclaimable" category and exclude it consciously as an area of public concern in favor of a more reclaimable environmentally-threatened area.

Perhaps the most significant compromise on the alternative of escape rather than confrontation is the erosion of our traditionally unqualified faith in the inevitable development of a "technological fix"; for example, chlorinated drinking water, to erase our previous neglect or damage to a scarce resource. Such faith may be increasingly a part of the realm of fantasy and less and less accomplishable without truly vast inputs of energy and scarce capital resources. Anti-pollution efforts tend to be high energy consuming activities, although efforts to prevent pollution require less energy in the long run than do efforts to clean up or compensate for environmental damage. One need only consider the huge capital investment expected to be needed to meet anticipated energy demands alone to realize that environmental reconstruction and even maintenance will face stiff competition in future political battles over use of limited revenues (for example, defense, energy, human services, etc.).

For all of the above reasons, we are going to have to develop and publicize means by which to accurately monitor environmental change and to plan for contingencies which have been postponed to the eleventh hour. Proposing and publicizing EMI and ERCI as public policy guides on a par with GNP is clearly not enough to generate the public consciousness and willingness to support necessary expenditures for environmental maintenance and reconstruction. The ultimate short run goal is the acceptance and use of such indices by governments not only as guides to immediate policy proposal evaluation but also for continuing education of the public (meaning groups and organizations such as large industrial corporations, as well as individuals) and for policy enforcement accountability. Every year we delay in developing reliable national indices to guide planning and public policy formulation the eventual cost of meeting environmental standards accelerates and the probability of environmental collapse in certain areas with repeated decimations of population is enhanced.

The readers of this article can have a critical role in the emergence of EMI and ERCI, or like indices, as policy guides and educational tools. While such indices would be useful at all levels of governmental organization, global, national, state, county, and city, the feasibility and utility of such measures should be demonstrated initially at the local level. One purpose of this statement is to encourage its readers to initiate discussion in their local governments of the need for highly visible indices of environmental quality. Every community has some form, however fragmented, of environmental monitoring going on. It would be an interesting, and perhaps entertaining, exercise to try to enumerate such activities in one's locality (e.g., testing of water quality, including drinking water, water for recreational use, and waste water treatment, air quality, radiation, public health, population density, adequacy of the housing stock, and monitoring of hazardous pollutants). Without such indices understood by the citizenry, it is difficult to hold public office holders accountable on their claims that they have contributed to the quality of life of their constituents. In addition, such indices might give us more tools to reduce the changes of inadvertently shutting down

the process of human ecological adaptation. If we fail to develop a greater understanding and awareness among the public as to the state of the environment and changes which compromise its ability to sustain life, then perhaps it is not too soon to begin discussion on the question, "When the Earth dies, where do we bury it?"

AFFAIRS OF CONSCIENCE IN ENVIRONMENTAL EDUCATION

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Occasionally we read someone's ideas and are changed. A few years ago I was reading Donald Michael's observations on American society, the future, and education. Michael asked what educators could do to assist in coping with the complex issues, problems and opportunities facing American society, and in answering the question he listed several "challenges for educators." (5:106-125) One of these challenges was "...educate for logical skill in recognizing and working through the ethically and morally tortuous dilemmas implicit in the assignment of social priorities and in the risks involved in seeking to attain them." (5:108) Michael's idea alerted me to the dimension of the problem of environmental education that has occupied me ever since. I have come to see environmental decision-making as making choices, assigning priorities, on the basis of values. Often values come into conflict between groups and even within individuals, and when this occurs we have "ethically and morally tortuous dilemmas" to work through. I will argue here that there are many such dilemmas to be found in environmental decision-making, and will use the large problem of America's economic growth and its implications for the Third World as a case in point.

Let us begin by describing the case. Allen Wheelis, in reflecting on slavery, described the problem clearly.

> "We have relieved ourselves of the guilt and responsibility of slave owners, while retaining our privilege of exploitation; for rather few of us white-skinned people in the northern part of the western hemisphere claim and receive most of the world's goods, and rather more of us with darker skin work in the fields and factories of the rest of the world and receive but a fraction of the world's goods." (12:59)

Some may argue that this is a matter of interpretation, but the facts support Wheelis' contention. There is currently a marked income disparity between people in the world as is clearly indicated in Figure 1.

Using as the measure the purchasing power in U. S. dollars in the poorest countries, World Bank figures reveal here a decile ratio of 13:1 between the richest and poorest countries. Commenting on this ratio the authors of a recent report on the international economic order note that the ratio and its trend "...must be deemed unacceptable for reasons of human decency....The existence of such disparities is incompatible with an equitable social and economic order....coming to terms with these differences is not only a precondition for attaining a fairer world: it also has a considerable bearing on mankind's success in surviving the twentieth century." (10:87-88)

From these figures and the comments upon them an ethical dilemma emerges. A world situation where some of the people have an inordinate amount of the wealth and resources is unjust. If the injustice is not to some degree rectified, serious social and political consequences, to say nothing of personal consequences like

POPULATION, INCOME PER CAPITA AND TOTAL INCOME 1970 IN U.S. $ WITH PURCHASING POWER IN POOREST COUNTRIES, WORLD AND FOUR GROUPS OF COUNTRIES (11)

	World	Third World countries (a)		Industrialized countries (b)	
		Total World	Poorest tenth world	Total World	Richest tenth world
	(1)	(2)	(3)	(4)	(5)
Population	3,667	2,588	368	1,089	363
Total Income (billion $)	1,526	490	~~31~~	925	405
Income/capita 1970 U.S. $ per person	415	190	85	1,010	1,100

(a) Countries included in lower decile: Afghanistan, Burma, Chad, Dahomey, Ethiopia, Indonesia, Malawi, Mali, Nepal, Niger, Pakistan + Bangladesh (part), Twanda, Somalia, Upper Volta, Yemen Arab Republic, Zaire.

(b) Countries included in upper decile: Belgium (part), Canada, Denmark, France, Norway, Sweden, Switzerland, United States, West Germany.

Note: Incomes in 1970 U.S. $. Incomes of richest countries divided by 2.25 as a correction for higher price level and for duplication (Tobin-Nordhans) and corrected for price level difference (David 4/9 rule).

FIGURE 1.

disease and starvation for the "have-nots", may occur. The people with the capacity to rectify this situation are those with the wealth and thus the power and the resources. So the responsibility to improve the world economic situation so described rests solidly on the shoulders of people in the developed and industrialized countries like the United States.

A person observing this situation from a position in middle class America faces a dilemma. What can he or she do? What should they do? What is right? It is my impression that many Americans simply abrogate their responsibility, deciding that the situation is too complex to understand, and that they are too insignificant to make any difference anyway. They do nothing. They continue merely to seek maximization of their material and economic condition and in so doing continue and even worsen the troublesome world condition which they have forcibly excluded from their minds.

While Americans go about the business of buying and selling and growing economically, the people of the Third World are aware of their plight and call for redress of the distributive injustice that prevails. They did so in the United Nations in 1974 when they called for fundamental institutional reform internationally that would allow developing nations greater economic self-determination than they now enjoy, would encourage transfer of real resources to Third World, and would effect a restructuring of the world monetary and international trade systems. The U. N. General Assembly incorporated these "demands" into the "Plan of Action" which they adopted without a vote at the Sixth Special Session on May 1, 1974. They were reaffirmed later the same year in the "Charter of Economic Rights and Duties of States" adopted by the Assembly.

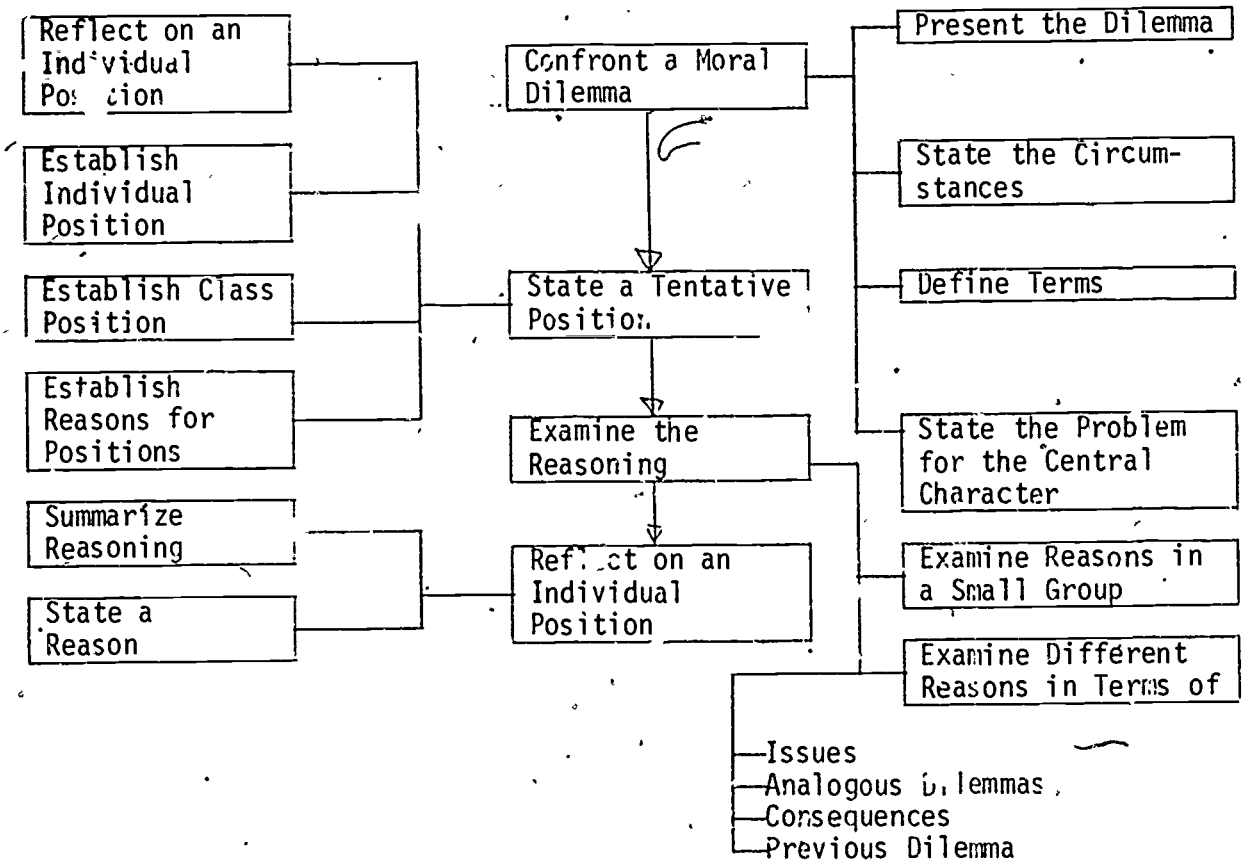
The developed nations look askance at such demands because they believe that such a restructuring of the economic order will have potentially painful effects upon their economies. The United States must maintain and increase the flows of energy, resources, and capital through its industrial system in order to maintain its rate of economic growth. Such maintainance depends upon the current system of economic interdependence which is, as a Third World representative to the United Nations observed, interdependence among unequal partners which results in the exploitation of the unequal partners. (1:36) So the United States and its people maintain a stance of dubious moral rectitude in regard to the problem of distributive justice, a problem of which many are ignorant and which others choose to ignore.

So what is to be done to rectify this injustice? Obviously many actions must be taken in political and economic arenas, and the specifics of these lie beyond my expertise to assess. I believe that there is a great challenge for education here, a challenge to present such ethically difficult situations as are briefly described and to assist people in perceiving their options and in making their choices. A particularly pressing but difficult task is to reveal how the lives of each person living and consuming in a wealthy nation like the United States relate to the lives of people in poor countries like Burma, Mali and Nepal. The most difficult challenge of all is to assist in the moral education of the American decision-maker, to encourage them along the path toward moral philosophy which will enable them to exercise moral reason in the choices they make which effect the environment, including the human community.

I am not sure how education can meet this challenge, but I can here explore a few possible avenues. First, it seems necessary to educate for moral development in the broadest sense. This is done by several institutions of society, one of which is the school. Much research is being done into moral education and methods of such

education are being developed and evaluated. (7) I have personally found Lawrence Kholberg's theory of moral development to be most helpful in understanding the process of moral growth and have reviewed it in an earlier paper. (5) A classroom adaptation of his theory will provide us with an example of how to raise the moral issues of America-Third World relations mentioned earlier.

Ronald E. Galbraith and Thomas Jones describe a teaching process involving confrontation of a moral dilemma, selection and statement of a position, examination of reasoning, and reflection on the individual position taken. (2) They diagram the approach as follows:



This approach is founded on the presentation of a dilemma which creates a genuine conflict for the individuals considering it. A cognitive moral conflict is set up requiring the student to choose between opposing values. Kohlberg argues that students develop to more mature levels of moral reasoning by engaging in discussions involving such conflict. Let us consider a moral dilemma that might emerge from the America-Third World problem which we are discussing.

One which might face academic people like us is as follows:

> Patrick has been studying about the world hunger situation for years. In his studies he has learned that his lifestyle is luxurious, even wasteful, and that millions of people in the world suffer from malnutrition while he eats too much. At times his conscience has bothered

him and he has said to himself, "Pat, you should do something about this situation." He has done so, attempting to walk and bicycle rather than drive to conserve energy, has tried to recycle everything he could, has grown part of his food, and has done many other things that he thinks make him less a part of the problem than he could be.

Still, he isn't satisfied h himself. When he stands in front of his students, describing the em and the sacrifices it seems to call for by people in the developed ntries, he feels vaguely guilty. He asks himself, "Am I saying do as I say, not as I do?" One Sunday evening over dinner with a colleague he is discussing the situation and remarks, "We really should do with less money, with less consumption. We could live more frugally, but we already do more than most folks. I think that the next time I get a raise, I'll donate the increase in my income to a charity that is doing good works for Third World people, like Schumacher's Intermediate Technology Development Group." Howard Stansbury, the colleague, nods his head in agreement.

Fourteen months later, Patrick wins a promotion involving a sizeable increase in his pay. He is elated, for now he can make a trip to Africa that he's long wanted to make in order to see for himself the conditions there. Over coffee one morning he tells Howard of his plans. "Ah, Pat," says Howard rather pensively, "What about your resolution to donate your next raise to Schumacher's Intermediate Technology Group. Did you decide not to do it?"

Pat is stunned. He has forgotten about that resolution as the months passed. The idea of a trip occurred to him, and he has excitedly applied for promotion, thinking that if he gets it he can study hunger "in site," perhaps write a scholarly paper, and advance his career. "Dammit, Howard," he says, "I forgot all about that."

Later, as he peddles his bike home from school, he turns the dilemma over in his mind. Clearly he wants to take the trip. It will further his education and perhaps even his career, moving him into a position where he might have influence and exercise power for the betterment of the hungry people of the world. On the other hand, how committed is he to the cause of betterment of the disadvantaged if he can't bring himself to make this minor sacrifice? How can he stand up and discuss distributive justice if he can't act on it himself?

What should Patrick do?

This situation demonstrates the five essential ingredients of a dilemma story as identified by Galbraith and Jones. (2:38-39) First, the situation in the dilemma focuses on a situation real to the group, in this case a dilemma which might face an environmental educator. Secondly, the story involves a central character around which the dilemma remains focused. And thirdly, the character must choose between two action alternatives which present a conflict. The conflict involves the fourth ingredient, a moral issue, in this case personal conscience in relation to distributive justice. Lastly, the dilemma ends with a specific question which asks what the character <u>should</u> do in the situation. These ingredients should be present when a dilemma is presented in order to bring about the desired discussion, but the specific strategy by which a dilemma is presented can vary. It might involve a short story, a film, a newspaper article, or another form, but the ingredients mentioned should all be present if the situation being resolved is to be real for the learner and lead to moral development.

This approach based on Kohlberg's theory of moral development is not the only way to incorporate "ethically and morally tortuous dilemmas" into environmental education. Douglas Superka and others developed a typology of values education approaches which includes moral development and four others. (9:4-5) One is inculcation, which involves various methods "to change the values of students so they more nearly reflect certain desired values." (9:4) This is a morally questionable educational approach in itself in which the instructor makes the choice rather than the student. It offers nothing to the environmental educator seeking to promote moral growth of the sort called for here. "Analysis" is a better approach and involves logical investigation to decide value issues and questions. Such investigation can lead to identification of moral dilemmas which can be worked through with emphasis on gathering and assessment of facts and a value decision based on infor ed judgment. Another approach is values clarification, but this only goes part way toward confronting and working through a moral dilemma. It encourages students to use both rational thought and emotional awareness to examine their personal feelings, values, and behavior, but does not go to the point of raising the question directly of what is morally right or wrong in the situation. Still, there is little doubt that values clarification strategies "...help to stimulate the progression in levels of moral thinking that Kohlberg has defined." (4:64)

The last approach described by Superka he calls "action learning." Here students are provided the opportunity for personal and social action based on their values. They undertake projects within their school or community, and in so doing must make choices, weigh their values against others, and examine moral dilemmas. This approach can obviously incorporate elements of the others. It is an approach familiar to environmental educators, but one which has perhaps not been appreciated by many for its potential to contribute to moral growth.

I review these approaches merely to point out that there are learning strategies available by which educators can, if they will, bring out the "ethically and morally tortuous dilemmas implicit in the assignment of social priorities" alluded to by Donald Michael. I have found the moral development approach most useful in my search for ways to approach the moral dimensions of environmental problems, but it is only one possibility. There are undoubtedly unexplored methods that should be examined.

The dilemma of the distribution of economic resources is that which I have elaborated to make my point here. Before concluding this discussion I wish to point out several other ethical problems that should interest environmental educators. This is by no means a complete list, but suggests a few obvious foci of ethical inquiry:

1. The problem of human right to a basic share of the earth's resources: Is there such a basic human right? If so, for example, is it then right for America to sell its grain only to those who can pay and to ignore those with caloric and nutritional deficiencies who are too poor to pay? Or, in another example, do poor, land-locked nations have any right to a portion of the fish protein harvested by coastal nations who can afford fishing fleets?

2. The problem of "short-term objective function": (7:283-306) Is it right to seek maximization of short-term rewards for the present generation at the expense of future generations? Randers and Meadows illustrate the problem: "The question about use or nonuse of DDT, for example, is easily resolved for the present generation. The fact that 1.3 billion people today can live in safety from malaria thanks to DDT outweighs the costs--

for instance, in the form of inedible fish--inflicted upon future generations through continued use of the chemical, if the short-term objective is man's only concern." (7:299-300)

3. The problem of ecologic ethics, of making decisions based on consideration of only part of the system, of only part of the community: Is it right to decide to modify an environment purely for the human benefit without inquiring as to what costs the modification will impose on the non-human community? This is the problem of whether or not humankind should be the source of all value.

4. The jobs versus environmental improvement problem: The making of adjustments in the economy toward solution of environmental problems may have adverse effects upon workers. Purposefully slowing economic growth in order to buy time while substitutes for rapidly depleting resources can be discovered may result in material production cutbacks and consequent unemployment. How is right action to be judged in such a situation?

5. The problem of corporate responsibility: What should be the source of ultimate value for human institutions, particularly economic institutions like the corporation? What responsibility do corporate executives have for the actions of their organizations which adversely effect ecological, including human, communities?

The list of such problems could go on, but my purpose here is simply to point out that there are numerous ethical and moral dilemmas inherent in environmental problems and their solution. Virtually all textbooks in environmental studies conclude with a brief chapter on "environmental ethics," but it is my observation that this is a sensitive area which most educators choose to avoid. People like Lawrence Kholberg, Sidney Simon, and Milton Rokeach, among many others, have stepped forward with research indicating that valuing and moral reasoning are processes which are learned throughout one's life experience. I am suggesting, with thanks to Donald Michael, that educators in general and environmental educators in particular have a responsibility to participate in the moral education of people making decisions in and about today's environment.

REFERENCES

1. Barraclough, Geoffrey. "The Haves and the Have-Nots," The New York Review, May 13, 1976; pp. 31-41.

2. Galbraith, Ronald E., Jones, Thomas M. Moral Reasoning, Minneapolis, Minnesota: Greenhaven Press, Inc., 1976.

3. Gray, Elizabeth, et al. Growth and Its Implications for the Future, Branford, Connecticut: The Dinosaur Press, 1975.

4. Kirshenbaum, Howard, Simon, Sidney B. Readings in Values Clarification, Minneapolis, Minnesota: Winston Press, 1973.

5. Michael, Donald. The Unprepared Society, New York: Basic Books, 1968.

6. Miles, John. "An Inquiry into the Importance of Studying Values in Environmental Education and the Means for Doing So," in Marlett, Robert (ed.) Current Issues in Environmental Education-II, Columbus, Ohio: The ERIC Center for Science, Mathematics, and Environmental Education, 1977, pp. 132-157.

7. Randers, Jorgen, Meadows, Donella. "The Carrying Capacity of Our Global Environment: A Look at Ethical Alternatives," in Daly, Herman (ed.) Toward a Steady State Economy, San Francisco: W. H. Freeman and Company, 1973.

8. Rosenzweig, Linda W. "A Selected Bibliography of Materials About Moral Education Based on the Research of Lawrence Kohlberg," Social Education, April 1976, pp. 208-212.

9. Superka, Douglas P., et al. Values Education Sourcebook. Boulder, Colorado: Social Science Education Consortium, 1976.

10. Tinbergen, Jan, Dolman, Anthony J., Van Ettinger, Jan. Reshaping the International Order, A Report to the Club of Rome, New York: E. P. Dutton, 1976.

11. Trends in Developing Countries. Washington: World Bank, 1973.

12. Wheelis, Allen. The Moralist, New York: Basic Books, 1973.

13. World Statistics in Brief. New York: United Nations, 1976.

PLUMBERS AND PHILOSOPHERS

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> "The society that scorns excellence in plumbing because it is a lowly activity, yet accepts shoddiness in philosophy because it is an exalted activity, will have neither good plumbing nor good philosophy, and as a result neither its pipes nor its theories will hold water."

We live in a society of highly developed scientific and technical expertise. When difficulties are encountered in this society, we bring to bear an equally well-developed skill, "problem-solving" Unfortunately, problem-solving has a way of increasing rather th. decreasing problems - the solution to one often results in several more related problems. While we recognize that ineffectual problem-solving is caused by our attempts to deal discretely with "isolated" problems, we have no alternative methods of dealing with these problems.

I would suggest that the difficulty lies not with our "plumbing", that is, our technology. Its health is superb! The difficulty lies in the fact that we have not developed the philosophical base necessary for understanding problems holistically from a "gestalt" point of view. While we have excellence in "plumbing", our philosophy is shoddy for it is no longer sufficient for a technological society. To use a plumber's example: The pipes will no longer carry enough water to meet the city's needs!

I would like to describe two alternate philosophical models, one of which is the philosophy of technology and the other the philosophy which I call an ecological philosophy. While they are not mutually exclusive, one is subsumed within the other as it gradually gives way to new understandings of the world in which we live.

That which I call the philosophy of technology had its beginnings when the first ape man picked up a bone and used it as a club. It's a long way from that event to modern technology, but pragmatism and problem-solving are but two highly sophisticated versions of the dawning conceptualization in the mind of that first ape man.

But let us look at the modern scientific and technological era which began in the late 1600's. The philosopher of technology was Descartes. Seeing that "all of the old traditional bases for men's beliefs were being undermined", he sought a new method by which men could attain certainty. "He tells us, first, to accept nothing until we see its truth clearly and distinctly." We must divide any difficult problem into smaller and smaller parts until we come to some proposition so simple that we see its self-evident truth. We can then build on this sure basis, always proceeding by small, self-evident steps. The self-evident starting point was man himself. From this came the belief that we can objectify everything outside ourselves - we become subject, it becomes object....The chief practitioner of this philosophy was Newton, the father of the modern scientific method. Newtonian science, atomistic, reductionist, mechanistic, and the technology to which it gave birth literally transformed

the world in which we live. This philosophy is linear in direction; it classifies and compartmentalizes; it is logical, and it works! The French, American and Industrial Revolutions attest to the power of this idea put into practice.

By necessity, in order to objectively study this world, man philosophically and intellectually stepped back from it, separating himself from the earth in order to study, explore, exploit and ultimately conquer the world in which he lives. And he achieved in the fulfillment of his wildest fantasies.

I would like to use another analogy which can provide a slightly different perspective on technological man. Using developmental psychology as the basis for my analogy, I would suggest that Homo sapiens has undergone the same stages of development that the human being undergoes, beginning at birth. The first stage in developmental psychology is the dependent stage where the child is totally dependent upon his environment for survival. When he has matured enough to creatively interact with that environment, he is considered to be an adolescent. At this stage he rebels against the environment in which he was raised, epitomized by adults in general and parents in particular. As they say, "Never trust anyone over thirty - he may be someone's dad." This process is more or less spread out and still hangs on well into adulthood. It is a process of proving one's self vis-a-vis his environment. Once this point has been reached he is ready to become independent and take his place in a world of "independent" people.

So with human societies. Homo sapiens had a long childhood, most of which was spent propitiating the various gods who controlled the world in which he sought to survive. His was a life of dependence, very much at the mercy of his environment. He was tied to the soil and intuitively understood that he was only a small part of the vast universe. As the species developed, it reached, in the western world, its adolescence, the time for rebellion and the move toward independence. Man began the process of proving himself vis-a-vis his environment. The revolutions gave western man the political power and his budding technology gave him the industrial power to achieve that independence, an independence that is today the goal of peoples across the entire planet. The Paul Bunyan myth epitomizes this struggle. And today that myth has been fulfilled. We have touched the sky with our skyscrapers; we have encompassed the globe with our communications grids; we have landed on the moon; we have touched the stars!

Homo sapiens has accomplished his fantasy. He is now in charge. We now recognize that to some degree at least cultural evolution has replaced natural evolution in determining the future of life on the planet. Man now has the capacity to determine the extent that life on the planet survives and the manner in which it will survive. At the same time we are beginning to recognize the fact that the kind of culture we inherited from our ancestors is beginning to challenge our ability to survive.

From the recognition that cultural evolution has replaced natural evolution, it is only a small step to the more sophisticated realization that cultural evolution is but another form of natural evolution and that Homo sapiens is and always has been an integral part of the planetary ecosystem. But his role has changed. While proving himself over against that upon which he was dependent, he could always trust that he has entered adulthood. In developing the rudiments of consciousness, our ancestors exploded the limits of genetically programmed behavior so that from behavior that was totally instinctual, man has evolved the capacity to determine his own behavior. He has achieved independence and suddenly is in

charge, not only of himself - his own species, but also of the world in which he lives. In Thomas Lewis' phrase he has become the nervous system of the planet. He has become dependent upon that world, but now it is also dependent upon him. Homo sapiens has reached the next developmental stage which Erikson calls generativity, and which I shall refer to as interdependence.

Just as the philosophy of dependence is inadequate for both the adolescent and the independent adult, the philosophy of independence is inadequate for the next stage of development, interdependence. We are on the threshold of that new stage and that fact calls for a philosophy to give it meaning.

Darwin was the first of our modern scientific era to recognize the holistic nature of life on the planet. Less than fifty years later, Einstein startled the scientific world with his theory of relativity. But, as Einstein once said, "Everything has changed but man's thinking." The technological momentum was far from spent. Since World War II it has, however, become increasingly counter-productive and our problem-solving skills are no longer effective.

The most adequate basis for a new philosophy that I have found is general systems theory. Growing out of organismic biology, it has begun to branch into most of the life and behavioral sciences. To the degree that general systems theory reflects the understandings of ecology, it is true to its organismic heritage, for ecology seems to provide the most adequate scientific base for an understanding of how systems function. It provides a holistic view of the world which accepts man as a part of, rather than apart from, the natural world. And, perhaps most important, ecology is a part of the experience base of every human being from which he can learn.

With ecology as a base, Laszlo provides an approach to the understanding of all systems by suggesting three levels of systems, suborganic, organic, and supra-organic or social systems. He suggests that the basic principles which govern one level of systems, govern all levels. These principles "traverse the spheres of physical, biological, and social phenomena and apply to systems of organized complexity wherever they are found and whatever their origin."

Man then becomes, in Laszlo's phrase, "the coordinating interface (system)" between the multi-level hierarchy of nature - learning from natural systems how to most effectively and efficiently operate human, social systems.

While man's evolutionary history determined that he become a cultural creature, it did not determine what kind of culture he would have. The kind of culture which we will have in the future will depend upon the set of values which we choose for the future. Those values inherent in the philosophy of technology can no longer suffice for a new philosophy demand, a new set of values. That basic value norms can be deduced directly from the contemporary scientific understanding of natural systems seems evident. However, man must specify these values to fit the human level for while remaining within the limits of general natural systems values, there are no specific ready-made value choices. Finding and respecting these limits is precisely the problem facing us today.

I would suggest that the raising of these value issues within the context of our ecological perspectives is one of the most critical issues facing us as environmental educators. A threefold challenge faces us, a challenge explicit in the following definition of environmental education:

> Environmental education is a process whereby an individual is encouraged to interact with his environment so that he:

1. becomes increasingly sensitive to that environment;

2. becomes more knowledgeable about that environment and its interrelationships; and

3. becomes aware of his responsibility to and for that environment.

We are most successful when we begin at the experience base which we all share, with a personal, affective awareness of our natural world. From this awareness, we add the cognitive dimensions which grow out of our scientific understanding of this world. Finally, we must face up to the realization that we are intrinsically responsible both to and for the entire ecosystem of the planet of which we are an integral part. Garrett Hardin defines intrinsic responsibility as that responsibility which if not exercised creates negative results for the irresponsible party. In this case, irresponsibility in the face of ecological necessity may destroy the planetary ecosystem and us with it.

John Gardner's quotation with which I began this paper explicitly recognizes the need for both good plumbing and good philosophy. Good technology is absolutely vital to our success for the future, for short of a total disaster we cannot return to a more primitive, pre-technological era. Evolution does not reverse itself. Once the ape man used his bone for a club, he was no longer to live without that club. But by recognizing the need for a sound philosophical basis we can decide, according to mutually acceptable normative values, the most effective role for technology in the generations ahead. Indeed, Robert Pirsig, in his book Zen and the Art of Motorcycle Maintenance, suggests that each of us, to one extent or another, is both plumber and philosopher. I would suggest that we get on with the task of exploring an ecological philosophy so that we may make the wisest possible decisions as to the directions for our societies in the decades to come.

EMPHASIS LEARNING

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THE ROLE OF SIMULATIONS AND GAMES IN ENVIRONMENTAL EDUCATION

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Introduction

"If man is to find his way successfully through the labyrinth of difficulties that confront him in the years ahead, he must, above all, use his intelligence. He can no longer rely upon the unforeseeable fortunate circumstance; future mistakes will have consequences far more dangerous than past ones have been. He must divorce himself from unreasoned slogans and dogma, from the soothsayer, from the person whose selfish interests compel him to draw false conclusions, from the man who prefers indoctrination to education. Man must rapidly accumulate knowledge concerning both his environment and himself, and he must learn how to use that knowledge wisely. He must encourage the emergence of new ideas in all areas. He must learn not to fear change, for of one thing he can be certain--no matter what happens in the world of the next few decades, change will be the major characteristic. But it is within the range of his ability to choose what the changes will be, and how the resources at his disposal will be used--or abused--in the common victory--or ignominious surrender--of mankind."

Harrison Brown in
The Challenge of Man's Future, 1954

"The future of all children is in the hands of all teachers. ...What kind of world do we want for children? This is the fundamental question for education."

Paul F. Brandwein, 1970

Roughly one million years of human history have been conveniently divided into ages by anthropologists who have sought to describe the status of man by the technological company he has kept. There were the Ages of Stone (New and Old), the Age of Copper, the Age of Bronze, the Age of Iron, and of recent eminence, the Age of the Atom. Unfortunately, the next three to five decades are surely to become known as the Age of Food, or according to some agronomists, the Time of Famines. This era will, undoubtedly, test the tenacity of underdeveloped nations, not to mention the food conscience of the overdeveloped nations, especially the United States. For decades the U. S. has unquestioningly shipped food, mostly in the form of cereal grains, to those undeveloped countries who had only to request it. Now, with the deepening realization that there soon will not be enough food to feed an exponentially

growing world population, even with perfect distribution, the United States finds itself in the unpopular role of wielding tremendous influence and food-power over the underdeveloped nations. The literally life-and-death decisions that are forthcoming rest squarely upon our shoulders. They will be political in nature and wide-sweeping in impact. In order for citizens of this country to know how to use this new influence wisely and to the benefit of a world society, they must become more knowledgeable and enlightened than ever before. For our representative democracy to function in the critical times ahead, our citizenry must be aware of and understand:

1. Attitudes that govern growth and stabilization of human populations;

2. The ability of this country to meet its own food needs in a period of colder and dryer world climate;

3. Methods of increasing agricultural yields while, simultaneously, minimizing environmental damage;

4. That energy resources are finite; a move toward more efficient uses of lower grade resources is the only feasible long-term alternative;

5. That stability of the ecosphere is dependent upon its complexity, and that the activities that weaken links in single overlapping systems endanger the whole; and

6. That man is a part of a natural scheme of life on this planet, and his well-being depends directly on the systems he attempts to change.

These and others [illegible] basic tenets of environmental education of the 1970's--education that cannot wait.

And yet many educators, while they are cognizant of a much different future awaiting their students, are unable to prepare them effectively for life in the last quarter of this century. Students apparently remain unconvinced of the applicability of social and scientific concepts to reality. A plethora of compartmentalized, seemingly unrelated "subjects" which constitute the school day of many students obscures their understanding of the interrelatedness and interdependencies of all facets of their existence. Ultimately, they may well join the ranks of the technologically alienated, that group that neither understands our advanced technology nor feels competent to challenge the somewhat aimless course it appears to be taking.

Although multi-disciplinary courses and units have ameliorated the compartmentalization effect to a slight extent by illustrating the interdependence of man and the ecosphere, there are other innovations which, at this time, appear efficacious in promoting active environmental learning atmospheres. These are the environmental simulations/games.

The balance of this paper is devoted to the potential role of simulations/games in viable environmental education programs. First, the emergence and essence of environmental education is discussed, followed by a brief history of simulations/games and their associated research findings. Second, several illustrations of environmental simulation games are presented in terms of their potential contributions to environmental education curricula.

The Environmental Education Imperative

> "...Unfortunately, most human problems do not fall neatly into such academic categories as sociology, history, economics, demography, psychology, or biology, and the solutions to these problems require the simultaneous application of the best ideas from many academic disciplines."
>
> Paul R. Erhlich in Population, Resources, and Environment, 1972.

Modern man has survived on this planet for many thousands of years, populating the planet, subjecting other species to his own use (and abuse), and developing new processes that match many natural ones in both intensity and scope. Suddenly, we have found reasons, some subtle and insidious, to question mankind's rapid rise to technological fame. These reasons are rooted in the tremendously magnified impacts of the demands that an ever-increasing human population makes on its natural environment. The power that man has exerted on the balance of nature now appears to threaten his own survival on several fronts. If we are surprised to find ourselves in a deepening morass of interwoven environmental crises, we can, at least, be encouraged by the current public awareness of it. This awareness is essential if we are to correct the serious problems that face us as a nation and a world society. The Intermediate Science Curriculum Project staff (1972) explains why this awareness is especially important for today's younger generation:

> "Of special significance is the coming of age of a generation who has a very special relationship to the environment. Young people today are the first generation to carry strontium-90 in their bones, DDT in their fat, and asbestos in their lungs. Their bodies will record the effects of these new environmental insults on human health, since they are the involuntary subjects of a huge world-wide experiment. Although many effects have already been documented, the full significance of this experiement will be discovered only after this generation has lived out its life. Only then will we have learned the long-term biological effects of so many novel agents, some of which interact to cause even greater effects than the sum of each taken separately. So it is our young people--and future generations--who may have to bear the ultimate consequences of today's environmental hazards."

The notion of public environmental education is not new. As a point of fact, as early as 1893, secondary school studies by the Committee of Ten urged that botany teachers take "an ecological approach" to their subject. In the decade that followed, educators argued eloquently for general "nature study" throughout education. Mark Terry writes in 1971:

> "Environmental education, whether termed 'ecology', 'nature study', or some other name, was championed at nearly all the life science curriculum meetings held in this country since the turn of the century. Particularly the relationship of man to environment has been recognized as worthy of coverage in public school curricula for generations."

Many educators have since attempted to justify or rationalize the need for environmental education in the public schools by arguing that a certain amount of

conservation education was necessary in order to produce an electorate knowledgeable and willing to participate in the management of natural resources. Others have promoted an appreciation of the aesthetic as the rightful pursuit of the American citizen. This past call for environmental education seems to reflect a human need to rejoin with nature.

Perhaps the best justification of the need for environmental education seen heretofore by this writer incorporates the concepts of an environmentally aware electorate and an appreciation of nature, and is eloquently expressed by Terry (1971):

> "...Before we are citizens in a representative democracy and before we are beings capable of appreciating nature, we are nature ourselves and are participants in the natural world. The need for environmental education, education concerning environmental principles and their applications, emanates from our extraordinary power to affect the natural environment. Animals and plants less capable of forcing environmental alterations are generally less conscious of environmental problems. Instincts take care of population problems for some species; catastrophes unlamented take care of similar problem for others."

Terry continues in the same paragraph:

> "Our capacity for altering environmental conditions is accompanied by a capacity for sensing values. Less controlled by instincts, we do not settle for catastrophe if we can help it. Values once oriented toward unlimited growth must now be tempered by our growing environmental understanding. The need for this reorientation of values is the need for environmental re-education. Freedom, in this case freedom from instinct, is synonymous with responsibility for environmental education."

Environmental education will make a necessary and vital contribution toward the establishment of a reasonable balance between man and natural systems. Hopefully, our youth, with attendant knowledge that bolsters wise decision-making, will be able to transform their legacy of crowded cities, polluted air and water, abused wildlife, and an assortment of other ills, into a quality inheritance.

In spite of the extensive emphasis on environment and environmental education, there is no widely accepted definition of the latter. A number of terms which denote broad ranges of meaning is found in the literature. Nature study, conservation education, outdoor education, and environmental education are, at times, used interchangeably. This is understandable, since they do possess a common goal: an understanding and appreciation of the natural world. In order to facilitate discussion in this paper, these four terms will be briefly described.

Nature study. Liberty Hyde Bailey and her associates at Cornell University were responsible for initiating the nature study movement in the early 1900's. Although scientific principles of the interrelated environment were not taught per se, one major goal was to acquaint children with aesthetic, curious, and unique aspects of their environment. Included in nature study were such content areas as soils, rural and urban locations and landscapes, aesthetics, economics and politics, and music. Emphasis was on nature drawings, plant and animal identification, field trips, measurement, and comparison. Bailey and followers concentrated their efforts on affective goals such as emotional, aesthetic, and moral values development.

Conservation education. Behind this movement one finds the "alphabetical conservators"; i.e., the U.S. Forest Service (USFS), the National Park Service (NPS), the Bureau of Land Management (BLM), the Soil Conservation Society of America (SCSA), the U. S. Atomic Energy Commission (AEC) which has just recently become part of the Energy Research and Development Association (ERDA), and other federal, state, and county departments of natural resources, soil and water conservation districts. Their common goal is to promote the wise and efficient use of our natural resources. (Unfortunately, "wise" and "efficient" are adjectives applied to man's utilization and exploitation of those resources, the latter two often being inconsistent with the long-term eco-stability of animal and plant species and, many times, reflecting little or no effort to regulate demand on a finite supply of non-renewable resources.) The greatest impact of conservation education has been in rural areas where natural resources have been a vital part of the local economy and where management caused immediate and visible effects.

Content areas have been the traditional soil, water, air, plant, and animal identification, wildlife management, forestry, agriculture, space, and energy. Emphasis has been on field trips, sampling and collecting, and recording of observations in the field.

A problem for the educator has been (and still is) the need to discern and properly weight the subjective views of conservation promoted by and suited to the industries involved.[1] However, in the past five years, this writer has witnessed several attempts by such agencies as the USFS and BLM to promote a cross-understanding of different conservation viewpoints by structuring cooperative workshops with educator groups.

Outdoor education. Dealing with more of an innovative climate than a unique set of content goals, outdoor education facilitates the achievement of various educational objectives by providing the vehicle. The literature of outdoor education describes its content domain as being similar to nature study and conservation education, but also included are objectives in areas such as social studies, language arts, music, health, and outdoor recreation skills like camping, hiking, mountaineering, ski-touring, survival technique, and physical conditioning. Values and appreciation are affective objectives, and inquiry is stressed in many district programs.

Environmental education. Obviously, much of what constitutes environmental education is not new; in fact, environmental education is such a broad set of topics that it may (and should) encompass the areas already discussed. Perhaps the best definition of environmental education that this writer has seen in a perusal of the literature is that stated by Stapp (1970). To paraphrase Stapp, environmental education is education designed to produce a citizenry that is knowledgeable concerning the interrelated bio-physical and socio-cultural environments, of which man is a part, and their associated problems, and is motivated to work toward solutions to those present and project problems. The goal of environmental education must be to fulfill the previously stated definition; major subgoals, as delineated by Stapp, are "to help citizens acquire:

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[1] Of course, the same can be said about the various environmental interest groups.

"1. A clear understanding that man is an inseparable part of a system, consisting of man, culture, and the bio-physical environment, and that man has the ability to alter the interrelationships of this system;

"2. A broad understanding of the bio-physical environmental problems confronting man, how to help solve these problems, and the responsibility of citizens and government to work toward their solution;

"3. A fundamental understanding of the bio-physical environment, both natural and man-made, and its role in contemporary society; and

"4. Attitudes of concern for the quality of the bio-physical environment which will motivate citizens to participate in bio-physical environmental problem-solving."

Several considerations and philosophies of environmental education are offered as a guide to those who would achieve the goals of environmental education through the agency of the public schools:

1. Emphasis should be placed on environmental education as a curriculum concern, kindergarten through grade twelve;

2. Environmental education should be multi-disciplinary and integrated into existing curricula;

3. Environmental education should encourage knowledge of ecology as a basis for understanding and solving contemporary environmental problems;

4. Environmental education should encourage valuing as it relates to the maintenance of a quality man/environment relationship; and

5. Environmental education should include out-of-the-classroom, experiential activities, including opportunities for children to experience less man-influenced environments.

According to Stegner (1970), the central theme of a K-12 environmental education program should be that man is a part of a natural earth system and is ultimately subject to the limitations of that system. Falkenstein (1971) urges that an environmental program must impart, in addition to an awareness of contemporary problems, a love and full understanding of our "earth, sky, and water" to students. Turk, et al. (1972), assert that viable environmental educational programs should heavily stress social problems and issues with emphasis on problem-solving and "rationalization of the trade-offs". Horn (1974) believes an inordinate amount of time and attention is given to the symptoms of environmental problems; environmental education must move in the direction of treating the causes of the problems. Creager, et al. (1975), write that environmental problems, as complex and interrelated as they may be, require an interdisciplinary approach and solution. No longer, they add, can we afford the luxury of being content in our own narrow academic fields.

Nevertheless, an overlapping concern that appears repeatedly in the literature is that effective incorporation of environmental education into our K-12 curricula is an absolute prerequisite if we are to bring man and society to a heightened awareness of the environmental problems that threaten us in the last quarter of this century--and motivate them to work toward favorable solutions of those problems.

Simulations/Games in Perspective

> "...game sessions were so exciting to observe that the interest and involvement of players were often accepted as evidence of learning without any hard statistical data."
>
> Boocock and Schild in Simulation Games in Learning, 1968

In spite of the fact that individual teachers have long used games or game-like devices to arouse student interest and to dramatize materials, simulations/games are still referred to as an educational "innovation". What is new about most of the games available today is the combination of the ancient technique of gaming with the relatively recent technique of simulation.[2] Moreover, when simulations/games have been accepted as appropriate for classroom use, the intention has been to arouse interest and to motivate students to further study. In essence, the simulations/games are designed to teach, as they are or in conjunction with other materials, just as a chapter in a textbook or a lecture can teach. There is, however, one important distinction: In a simulated environment a student is free to experience first-hand the consequences of his actions and decisions without suffering damage to his peer facade. "Games and other dramatic play offer expanded possibilities for action in a mode that is chiefly mental, yet includes the felt freedom, intuitive speed, and reactive responses of physical movements" (Abt and Cogger, 1972, p. 36).

Although a few writers (Lewis and Wentworth, 1971, p. 8) have been cautious in their endorsement of the potential of educational games and simulations, a great number of others has given enthusiastic support to such activities as "an ideal method for modernizing the social studies curriculum in secondary schools...Simulation games can be one of the foundations for a truly vitalized educational system and...this technique, given the right conditions, can make a profound contribution to the growth and development of our young people so that they can be better prepared for life in the modern world" (Lee and O'Leary, 1971, pp. 345-346).

If one excepts war games from the field of simulations/games, the history of the latter extends from the early 1960's when over a hundred management games were in use throughout the nation. In addition, at this time, many simulations were being developed for use in predicting the consequences of foreign affairs decisions, many of which served as models for educational learning games.

PHASE 1: Acceptance on Faith[3] (1960-1963): During this brief period, "gaming"

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[2] War games, really a type of simulated game, have been in existence for centuries. However, it is only since World War II that simulations have found any extended use in the social sciences, and their introduction into environmental education is very recent.

[3] Adapted from Sarane S. Boocock and E. O. Schild, Simulation Games in Learning, Sage Publications, Inc., 1968, pp. 15-18.

was applied as a learning technique for the classroom, and several simulations were developed and field-tested. Based on cursory observations of classroom utility and student reaction, enthusiasm for the new technique became widespread--even in view of the lack of statistical validation. Not surprisingly, because the field was new and small, researchers were concentrating on the design of educational games--not on their evaluation. This phase seems to be typical of any new educational innovation and its related research. Additionally, the "game sessions were so exciting to observe that the interest and involvement of players were often accepted as evidence of learning" without any hard statistical data (Boocock and Schild, 1968, p. 16).

PHASE 2: Post-honeymoon (1963-1970): Controlled experimentation with games during this period led to generally equivocal findings regarding their effectiveness and pointed to the following "sobering conclusions":

a)"...games are not a panacea for all educational ills;

b) games in their present forms have serious flaws; and

c) neither standard tests nor the relatively crude instruments designed specifically to evaluate a particular game or games are adequate or sufficient measures for the impact of games" (Boocock and Schild, 1968, p. 16)

More experimentation gave way to more unsettling findings:

d) Games do teach, but the mechanism is unknown.

e) Games do motivate and arouse student interest (the novelty effect not discounted).

f) Games induce critical thinking and change attitudes (again, mechanism unknown).

g) There is no substantial evidence that games teach facts or problem-solving skills, or induce critical thinking any more than conventional methods of learning.

PHASE 3: Realistic Optimism (1970 to present): Accumulated evidence and experience in the past five years have led to a more tempered optimism of the teaching and learning potentials of simulations/games. Limited progress has been made on three broad fronts:

1. A number of different simulation games have been field-tested in a wide variety of educational settings.

2. Pools of data have accumulated on the learning effects of specific games and, in several cases, a particular game has been evaluated by one or more researchers other than the game's original developer.

3. Based on the available research, theorists have revised and classified the purported "gains" of classroom utility of learning games.

What does research say to the educator? The reader should bear in mind that, because of the dearth of research in the area of environmental simulations/games, it is necessary to draw upon the rather nebulous findings of social studies

simulations/games research in order to accurately illustrate what is known (and what is not), as well as to identify voids in the field.

In 1966 in a paper summarizing a number of research reports, C. H. Cherryholmes concluded that no positive educational benefit accrued to participants in simulations/games over and above the control groups (traditional/conventional instruction). His only positive conclusion: Students enjoy participating in simulation games more than they enjoy conventional teaching strategies. This is consistent with the findings of the Academic Games Program's research (Coleman, et al., 1973, p. 6): "Students prefer games to other classroom activities. This finding holds true for students from elementary school through high school and for both simulation and non-simulation games."

Especially in the cognitive area, there has been conflicting evidence concerning student achievement as a result of learning games. Usually, as evidenced by paper and pencil tests, student achievement has been found to be neither significantly better nor worse with simulation games than with other learning experiences. There are six studies which stand as exceptions to this generalization. Two of them (Monroe, 1968; Wentworth, 1972) indicated that junior college students in control classes who had not used learning games scored significantly higher than did students in experimental groups involving game play. Both researchers concluded that lectures were more effective in teaching theory of economic systems; however, Wentworth stated that the learning game, MARKETPLACE, was more effective in teaching system dynamics than were lectures.

Allen, et al., stated in 1966 that fourth-grade students playing the WIFF'N PROOF game scored significantly higher on an author-devised content test than did a control group of students. However, the results are confounded by suspicions of developer bias.

The results of the Baker study (1966) indicated that junior high school students participating in a history simulation game fared better on content tests than did the control group; however, he taught both groups himself, developed the cognitive instrument, and used a long-term role-playing simulation which was non-representative of the usual exercises considered part of the course. His study lost more credibility when a similar experiment was conducted three years later and no significant differences in cognitive gain were found.

Duke (1964) found positive gains for students who participated in an urban land-use game, but his "home-bred" testing instrument was not subjected to validity or reliability tests; thus, considerable developer bias may be present in his study as well.

A research design with greater controls than the previous studies was utilized by Boocock (1966) in which she used a battery of seven commercially available games. Her conclusion was that participants in the seven-game battery displayed greater intellectual learning than did their control group counterparts. However, since her sample of 4H convention participants probably reflects considerable selection bias, her conclusions must be taken with caution.

In a 1972 paper, Keach and Pierfy maintained that a properly designed simulation/game is a viable way in which to teach facts, if the activity provides opportunities for participants to apply those facts. No evidence was presented to substantiate this claim.

Stembler (1972) asserted that a simulation/game taught cognitive information

significantly better than the teacher-lecture method, but he qualified his conclusion by stating that for a game to bring about this sort of outcome, it must abandon open-ended approaches and be designed so that the participant reaches a predetermined goal or conclusion. In other words, according to Stembler, the simulation/game must guide like programmed instruction. However, much more study in this area is needed.

Of the many studies whose findings indicated no significant differences in student learning between the experimental and control groups, one or more of the following was usually present:

1. Selection bias;
2. Non-standardized testing instruments;
3. Inadequate experimental controls;
4. Studies impossible to replicate;
5. Developer bias;
6. Unusual use of statistical analysis;
7. Small samples;
8. Hawthorne Effect.

The greatest impact of simulations/games appears to be in the area of affective learning. Studies by Garvey and Seiler (1966), Wing (1966), Baker (1966), Dooley (1969), Stadsklev (1969), Cordtz (1969), Lloyd (1970), and Cohen (1970) indicated the formation of positive student attitudes toward simulation gaming as a viable learning experience.

Other studies attempted to show changes in student attitudes toward particular subject/interest areas influenced by participation in learning games. For example, Heinkel (1970), after utilizing one play of the legislative simulation, NAPOLI, and post-testing, concluded that the only significant result was that the simulation caused his college students to view politicians in a more positive light than previously. Using a similar method, Livingston (1970) found that the attitudes of students who played GHETTO were significantly more favorable to the poor. In another study of the legislative process, he concluded that students' attitudes toward political "log-rolling" were considerably ameliorated after one play of the simulation game, DEMOCRACY. No other significant findings were reported in that study.

Studies completed by Targ (1967), DeKock (1969), Corbin (1971), Boocock (1966), and Vogel (1970) attempted to discover the impact of learning games upon specified social, economic, or political attitudes of students. Limitations notwithstanding, the following were indicated:

1. Students became more tolerant and positive in their opinions after being exposed to the simulation.
2. Students' attitudes toward politicians and political processes were altered positively.

3. Students were more acceptive of the social differences among partici nts in the simulation.

Although the affective impact of simulations/gar s seems more emphatic than the cognitive impact, these studies also suffer from the same maladies listed above. Again, it must be emphasized that most or the findings lack generalizability because the researchers (often the game developers) drew conclusions based on data obtained from small samples, mary of which suffered from extreme selection bias.

Simulations/Games and Environmental Education: A Potent Synergism

> "...In my opinion Colorado had no environmental problems before the advent of environmentalists. Now, it is obvious to me that Colorado's most pressing problem is that of controlling the environmentalist population..."
>
> Senator Murphy in the Colorado: Problems and Promises game

How can simulations/games teach students the complex interdependencies inherent in an analysis of the population/resources/environment issues? Environmental simulations/games provide students with models of the real world, paradigms through which they may interact and experiment with alternative strategies toward the resolution of local, state, or global environmental problems. Since so few people wish to risk the consequences of experimenting in the real-world situation, the use of environmental simulations and games can be a valuable educational technique. Students may assume roles, face environmental problems, formulate strategies, make decisions, and obtain rapid feedback on the consequences of their decisions. Additionally, the student must apply the facts and concepts undergirding the environmental simulation in order that he can effectively "play the game". Motivation, concept learning, the application of facts to problem-solving, and the examination of alternative solutions to the population/resources/environment crisis appear to be improved through the use of efficient and realistic environmental simulations and games.

Implying that environmental simulations/games provide the student with a more variegated, more complex, and more integrated world view than is provided by most other educational methods assumes a certain orientation toward environmental study. Although simulation-gaming did not arise from, nor does it pretend to represent, a full-blown educational philosophy, it seems to be most heartily subscribed to by those already holding a philosophy that emphasizes certain aspects of teaching/learning that are believed to be incorporated in simulations/games. This educational philosophy emphasizes that environmental knowledge is dynamic (not fixed) and interrelated, and that understanding the dynamics of socio-scientific systems is what is important. For example, "students should develop a sense about what they and others do not know--as well as about what is known....they should develop a healthy skepticism regarding 'truth' and 'proof', recognizing these to be man-made and human-oriented--and heir to human fallibility. Knowledge is created out of personal experience, both individual and shared. Students learn from one another and from the synergistic outcomes of the group" (Chapman and Davis, 1973, p. 15).

According to Robert E. Horn's 1977 edition of the Guide to Simulations/Games for Education and Training, the number of simulations/games of all types has increased by a factor of three from 1971 (400) to 1977 (over 1200). Of the six hundred simulations/games of all types commercially available in 1973, approximately twenty-four (4%) were environmental simulations, most of which were multi-disciplinary and dealt with one or more aspects of the population/resources/environment crisis (Zuckerman and Horn, 1973). The 1977 edition of the Guide lists fifty-four environmental simulations, the number more than double the 1973 figure and accounting for approximately 4.5% of the total number of simulations/games commercially available.

Some of these environmental games, created in the tailwind of the ecology bandwagon, represent little more than an attempt by developer and publisher to capitalize on the popularity of the ecology market. Others, however, represent clever and exciting models of reality that appear able to create favorable and impressionable learning atmospheres in the complex interdisciplinary realm of environmental education. Of these, several are very complex, utilizing computers and a week or more of playing time.

Yet, in spite of this proliferation and diffusion of educational simulations/games, those of the type designed to promote awareness and understanding of environmental problems are not being utilized in the classroom nearly as quickly as they are proliferating on publishers' lists.[4] Why, in view of the grave environmental dilemma facing us today, are environmental simulations and games being utilized to the slight extent observed? Speculation yields the following rationalizations:

1. As is characteristic of any newly-emerging innovation in education, the available research on simulations/games (not to mention environmental simulation games) is equivocal regarding the potential benefits students can be expected to gain through their use.

2. While environmental simulations/games are often viewed as exciting educational tools by students, they are just as often seen as highly complicated, strange, slightly upsetting activities by teachers who have never experienced them.

3. The contemporary practice of providing open, unstructured, student-centered lessons may contradict the philosophy of the teacher who has never been able to relinquish "learning control" to his pupils; thus, simulations/games may be construed as a threat to the authoritarian environmental educator.

4. It is very difficult for educators to gain insight into any of the environmental simulations and games by a cursory perusal of the package. Unless the simulation or game is previewed by actual teacher participation in its scenario and sequence, it is unlikely that the game will be taken off the storeroom shelf.

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4 At least in Colorado the popularity of environmental simulations/games as compared with traditional teaching strategies in environmental education has been extremely low, as was reported by Bottinelli (1976, p. 42).

5. It is true that the rather high costs of classroom sets of simulations/games materials relative to other instructional costs can act as a deterrent to their widespread usage, especially at a time when most school districts are feeling the economic pinch.

Nevertheless, it seems that once the obscuring cloud of haphazard and apparently contradictory research findings is lifted by more elucidating research, the popularity and use of environmental simulations and games will increase dramatically, thus lowering costs. Additionally, widespread teacher in-service workshops which promote multi-disciplinary activities, such as simulations/games, will give added impetus to the implementation of environmental games in environmental education programs.

Dale Farran first commented in 1971 that a possible synergistic effect linked simulations/games with traditional teaching strategy. Farran stated that simulations and games appear to act "as a frame of reference to unite separate ideas students have learned prior to encountering the games." He concluded that games are unique in providing active arenas for "decision-making, relational thinking and planning." It is possible and highly probable that simulations and games have their greatest cognitive and affective impact when they are integrated into traditional/conventional teaching strategies. In this way, a natural complementarity acts to enhance the effectiveness of the entire teaching strategy.

Six environmental simulation games, which the author has found to be effective for the classroom and the indicated grade levels, are briefly reviewed below with respect to their potential contributions to secondary environmental education programs. Availability information is also noted for each of the games.

THE ENERGY-ENVIRONMENT GAME (Grades 9-12, college, adult): This game, developed in 1973 by the Edison Electric Institute, is a simulation of the role-play type which deals with the energy crisis. The objective is to locate a new power production facility in a hypothetical region where the demand for electrical energy has surpassed supply. Twenty to forty students assume roles, equally divided among environmentalists, power company officials, business professionals and lay citizens, as they provide input to the "Governor's Commission on Energy and the Environment." Players are exposed to numerous viewpoints and attitudes related to energy production and consumption during four to eight periods of play. The necessity of arriving at viable compromises or trade-offs between demand and environmental impacts is a basic theme of the game. Multi-disciplinary in character, the ENERGY-ENVIRONMENT GAME can be of special value when incorporated in traditional science and social studies lessons concerning the energy crisis. (Cost: $20; Edison Electric Institute, 90 Park Avenue, New York, New York 10016).

ENERGY X (Grades 7-12, college, adult): "Energy X", a hypothetical substance discovered in a meteorite, is an overpowering source of energy, almost totally non-polluting and extremely versatile in its end-use applications. However, the amount of "Energy X" recovered from the meteorite is only sufficient for three years of use and in only three of the eight U. S. regions chosen by the "congressional committee". It is the task of participants to analyze resource use, consumption and production in the United States today, thus establishing a rationale for the allocation of "Energy X". During the course of the simulation, students develop an awareness of the need for intelligent use of the many alternative energy sources and an understanding of the relationships between the location of major energy sources, population, regional differences, and related

economic conditions. An audio cassette and filmstrip, included in the game kit, as well as a series of charts, tables and graphs, add authenticity to the simulation as the "regional representatives" (students) attempt to present the best cases they can for obtaining a portion of the supply of "Energy X" for use in their home areas. (Cost: $19.50; Ideal School Supply Company, 11000 South Lavergne Avenue, Oak Lawn, Illinois 60453).

THE PLANET MANAGEMENT GAME (Grades 6-12, college, adult): One of the most effective simulation games which demonstrates the interdependencies of population growth, food supplies, gross national product and environmental quality, PLANET MANAGEMENT involves students who participate as managers of a hypothetical planet, Clarion, as colonization is begun. Students must decide how to spend a limited five-year budget, allocating funds among improvement projects such as agricultural research, highway construction, medical research and energy production. After a consensus is reached, the decisions are input to a cardboard "computer" which shows the effects of those decisions in four categories: population level, food supply, per capita income, and an environmental quality index. At the end of ten rounds of play, students analyze the effects of their decisions and the kind of life they have imparted to the "Clarionpeople". Debriefing emphasizes the similarities between the hypothetical planet and Earth. Three to four periods of class time are adequate to play the game. (Cost: $13.50; Houghton Mifflin Company, 110 Tremont Street, Boston, Massachusetts 02107).

GOMPSTON: A POLLUTED CITY (Grades 9-12, college, adult): This simulation game focuses on a case study of a hypothetical city, Gompston, entangled in the throes of an advanced stage of air and water pollution. During the course of play (four to seven class periods), students assume the roles of forty local and state officials as they conduct a town meeting to discuss their problems and find solutions to their local environmental crises. A filmstrip and audio cassette provide participants with a history of Gompston and glimpses of various sections of the floodplain city. Students are motivated to research pollution abatement technologies and to devise solutions to Gompston's problems while attempting to retain their own speical interests. That there are no simple solutions to extremely complicated problems and that trade-offs must be made are the dual themes of GOMPSTON. Two transparencies and large display posters are included in the game package in addition to the teacher's guide and special interest nameplates. As in ENERGY X a serious attempt is made by the developer to assess learning outcomes via self-evaluation forms. This game can be effectively utilized in secondary science/social studies/environmental education courses. (Cost: $25; Ideal School Supply Company, 11000 South Lavergne Avenue, Oak Lawn, Illinois 60453).

COLORADO: PROBLEMS & PROMISES (Grades 10-12, college, adult): A brand new simulation game, COLORADO: PROBLEMS & PROMISES, focuses on twenty-five environmental "bills", originating in and passed by the "Colorado House of Representatives: and delivered to the "Colorado Senate". Students play the roles of thirty-five hypothetical state senators, each espousing a unique environmental philosophy, background and political aspirations. Provisions are included for combining science and social studies classes and increasing the number of roles portrayed with the addition of lobbyists and special interest groups. The simulation centers on Colorado policy-making and involves the complex interrelationships of the social, psychological, economic and environmental realms. Its objective is to stimulate fruitful interaction and informed debate of the contemporary environmental issues confronting Colorado, while creating an awareness of the compromises and trade-offs that must ultimately be considered.

Designed for seven to ten class periods and from seven to seventy students, the

game provides opportunities for players to learn the legislative process and understand twenty-five environmental issues in an exciting fashion. Among the issues available for study within the game context are population control and redistribution, energy resources, and mandatory conservation measures, water storage projects, weather modification, predator control, wilderness reserves and fluorocarbon propellants. The game can be effectively utilized in social studies, science and environmental educat on classes while, hopefully, motivating students to become more actively involved on their own. Provisions for senatorial re-elections, debriefing and evaluation are also included in the game kit. Additionally, the game can be modified to reflect the legislative processes and environmental issues of other states. (Cost: Free to Colorado schools participating in implementation workshops; for information regarding availability to educators in other states, please write to: Public Service Company of Colorado, P. O. Box 840, Denver, Colorado 80231).

BALDICER (Grades 9-12, college, adult): A popular simulation game that deals with with food production and distribution inequities, BALDICER (an acronym for BALanced DIet CERtificates) was primarily designed to stimulate interest in a study of the complex problems involved in feeding a burgeoning world population in an age in which we have the technological skill to accomplish such a task but have not done so. Specific purposes of BALDICER are for students to experience the economic interdependence of the world and to gain insight into the issues of population control, mechanization, colonization, inflation, the unequal distribution of resources and famine.

Students play the roles of "Food Coordinators", each student representing 120 million people, as they attempt to provide adequate food supplies each year. Students must decide how to invest resources in the most efficient manner, balanced among subsistence, capital investment, population control and readiness for natural disaster. Ten to twenty students may play and three to four class periods are adequate. A debriefing session is vital at which time ethical issues will undoubtedly be raised as participants relate their game behavior to the actual ethical convictions they hold. (Cost: $25; John Knox Press, Box 1176, Richmond, Virginia 23209).

Environmental simulations and games can be of immeasurable value in teaching the multi-faceted and complex issues presented in environmental education units, modules and courses. Although research findings in the cognitive domain are equivocal at thi, time, the true value of good environmental simulations and games may not be amenable to measurement by paper and pencil tests. Rather, like good art and music, environmental games may instill a deep appreciation of the interrelatedness of all aspects of the ecosphere in the player--deeper than the statistical impression gained by the researcher.

REFERENCES

Abt, Clark C. and Virginia H. Cogger. "Educational Games for the Sciences," The Science Teacher, 36(1):36-39, 1969.

Allen, L. E., R. W. Allen, and J. C. Miller. "Programmed Games and the Learning of Problem Solving Skills: The Wiff'n Proof Example," The Journal of Educational Research, 55:22-25, 1966.

Baker, E. H. "A Comparative Study of Textbook and Simulation Approaches in Teaching Junior High School American History." Unpublished doctoral dissertation, Northwestern University, 1966.

Boocock, S. S. "The Effects of Games with Simulated Environments Upon Student Learning." Unpublished doctoral dissertation, Johns Hopkins University, 1966.

Boocock, Sarane S. and E. O. Schild (Eds.). Simulation Games in Learning. Sage Publications, 1968.

Bottinelli, Charles A. "A Brief Summary of the Status of Secondary Environmental Education in Colorado," Journal of Environmental Education, 7(4):38-45, 1976.

Brown, Harrison. The Challenge of Man's Future. Viking Press, 1954.

Chapman, Katherine, James E. Davis, and Andrea Meier. Simulation/Games in Social Studies: What Do We Know? Social Science Education Consortium/ ERIC Clearinghouse for Social Studies Education, 1973.

Cherryholmes, C. H. "Some Current Research on Effectiveness of Educational Simulations: Implications for Alternative Strategies," The American Behavioral Scientist, 10:4-7, 1966.

Cohen, K. C. "Effects of the CONSUMER GAME on Learning and Attitudes of Selected Seventh Grade Students in a Target-Area School," Report No. 65. The Center for the Study of Social Organization of Schools, Johns Hopkins University, 1970.

Coleman, James S., et al. "The Hopkins Games Program: Conclusions from Seven Years of Research," Social Education, pp. 3-7, August 1973.

Corbin, W. S. "The Effects of a Simulation Game about S.E. Asia on Political, Economic and Social Attitudes of Ninth Grade Students." Unpublished doctoral dissertation, The University of Rochester, 1971.

Cordtz, W. W. "A Simulation Methodology of Instruction in a College Course of American Studies." Unpublished doctoral dissertation, United States International University, 1969.

Creager, Joan C., et al. "A Declaration on Interdisciplinary Environmental Education," The Science Teacher, pp. 14-15, February 1975.

Dekock, P. "Simulations and Changes in Racial Attitudes," Social Education, 33:181-183, 1969.

Dooley, B. J. "Research on the Market Game," in G. Dawson (Ed.) Economic Education Experiences of Enterprising Teachers, Volume 5. New York: Joint Council on Economic Education, 1969.

Duke, R. D. "Gaming-Simulation Studies in Urban Land Use Allocation." Unpublished doctoral dissertation, University of Michigan, 1964.

Erhlich, Paul R. and Anne H. Erhlich. Population, Resources, and Environment. Freeman and Co., 1972.

Falkenstein, W. J. "Environmental Education," West Linn School District 3, Oregon, 1971. ED 055 871.

Farran, Dale C. "Competition and Learning for Underachievers," in S. Boocock and E. O. Schild (Eds.) Simulation Games in Learning. Sage Publications, 1968.

Garvey, D. M. and W. H. Seiler. "A Study of Effectiveness of Different Methods of Teaching International Relations to High School Students." Final Report, Cooperative Research Project No. S-270. Emporia: Kansas State Teachers College, 1966.

Heinkel, Otto A. "Evaluation of Simulation as a Teaching Device," Journal of Experimental Education, 38(3):32-36, 1970.

Horn, A. D. "Why Study Energy?", a preface to Energy and Man's Environment. Washington State: Educational/Research Systems, Inc., 1974.

Horn, Robert E. The Guide to Simulations/Games for Education and Training. Didactic Systems, Inc., 1977.

Intermediate Science Curriculum Study Staff. Environmental Science. Silver Burdett, 1972.

Keatch, E. T. and D. A. Pierfy. "The Effects of a Simulation Game on Learning of Geographic Information at the Fifth Grade Level." University of Georgia, Dept. of Social Science Education, September 1972. ED 068 889.

Lee, R. S. and A. O'Leary. "Attitude and Personality Effects of a Three-Day Simulation," Simulation and Games, 2:345-346, 1971.

Lewis, D. R. and D. Wentworth. Games and Simulations for Teaching Economics. New York: Joint Council on Economic Education, 1971.

Livingston, Samuel J. "Simulation Games as Advance Organizers in the Learning of Social Science Materials: Experiments 1-3." Baltimore: Johns Hopkins University, 1970. ED 039 156.

Lloyd, J. W. "Role-Playing, Collective Bargaining, and the Measurement of Attitude Change," Journal of Economic Education, 1:104-110, 1970.

Monroe, M. W. "Games as Teaching Tools: An Examination of the COMMUNITY LAND USE GAME." Unpublished master's thesis, Cornell University, 1968.

Stadsklev, R. A. "A Comparative Study of Simulation Gaming and Lecture-Discussion Method." Unpublished Master's thesis, University of Minnesota, 1969.

Stapp, William B. "Environmental Encounters," Journal of Environmental Education, 2(1), Fall 1970; as cited by Troost and Altman, Environmental Education: A Sourcebook. Wiley and Sons, 1972.

Stegner, Robert W. "Characteristics of a Model K-12 Population Education Program." Paper presented at the College and University Meetings of the National Council of Social Studies, New York, 1970.

Stembler, William A. "Teaching Facts Through Simulation: The World War I Game," Social Science Record, 9(3):30-31, 1972.

Targ, H. R. "Impacts of an Elementary School INTER-NATION SIMULATION on Developing Orientations to International Politics." Unpublished doctoral dissertation, Northwestern University, 1967.

Terry, Mark. Teaching for Survival. New York: Friends of the Earth/Ballantine, 1971.

Turk, Amos, Jonathan Turk, and Janet T. Wittes. Ecology, Pollution, Environment. Pennsylvania: Saunders Co., 1972.

Vogel, R. W. "The Effect of a Simulation Game on the Attitudes of Political Efficiacy of Sixth-Grade Students." Unpublished master's thesis, University of Alberta, 1970.

Wentworth, D. R. "The Effectiveness of a Learning Game for Teaching Introductory Economics in Selected Two-Year Colleges." Unpublished doctoral dissertation, University of Minnesota, 1972.

Wing, R. L. Two Computer-Based Economics Games for Sixth Graders," American Behavioral Scientist, 10:31-33, 1966.

Zuckerman, David W. and Robert E. Horn. The Guide to Simulations/Games for Education and Training. Research Media, Inc., 1973.

REVIEW OF SELECTED INSTRUMENTS THAT MEASURE ENVIRONMENTAL EDUCATION OUTCOMES

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In the last few decades, interest in and concern about the environmental problems we experienced has caused a series of attempts to solve the environmental problems "educationally." There has been produced a large amount of instructional materials by commercial publishing companies as well as inumerable locally developed curricula and programs, many of which emphasized an outdoor, nature study, or camping component. Helgeson, et al. (1971) surveyed a large number of these environmental education programs in a document entitled A Review of Environmental Education for School Administrators. Based on information collected during the spring and summer of 1971 from the program directors, Helgeson, et al., concluded that "Evaluation of the effect of program and material on student and communities is needed." Very few schools and material developers obtained "hard" evaluative data regarding the effects of their program and material. Many based their evaluation on open-ended, qualitative data gathered by the program staff. One such evaluation said - "while no data are currently available, it has been reported that students show evidence of increased awareness, sharpened sense of the environment and of the interweaving of self and world." Some programs and material have stated specific (sometimes even behavioral) objectives of the cognitive, affective, and behavioral domains, but failed to follow through with a measurement of these objectives. Swan (1971) and others have noted previously that "we do not have effective tools for evaluating the effectiveness of environmental education programs."

One difficulty in evaluating the environmental education programs is that it is still a relatively young field and an interdisciplinary undertaking. Because of the youthfulness of the field, there is still discussion over what are the key objectives and in which domain (cognitive, affective, psychomotor) the major emphasis should be. In this paper, it will be assumed that outcomes in all domains are important. As a first step toward measuring these outcomes, Bennett (1974) has clearly stated that the "affective, cognitive, and skill goals of environmental education must be translated into behavioral terms before any kind of meaningful evaluation can be attempted." Many programs and authors (notably Bennett and the New Jersey State Countil for EE) have produced laudable models in this regard.

Roth (1971) and others have attempted to construct schemes of the major concepts and/or processes appropriate to environmental education. This task is especially difficult in an interdisciplinary field.

To facilitate the development of measurement techniques, one must either explicitly or implicity conceptualize the behavioral outcomes with respect to a particular grouping of concepts. Much of the measurement research in EE is lax in this regard. As the field matures, more explicit statements are appearing. Another encouraging development (in my estimation) is the healthy symbiosis beginning to be established between EE and several behavioral science fields.

One technique that aids test developers is a two-dimensional chart representing

content divisions and specific behavioral outcomes. This chart, sometimes called a table of specifications, aids in the establishment and substantiation of content validity. The table is a necessary, but not sufficient condition for producing a balanced, representative test or inventory. In developing the cognitive forms of the Syracuse Environmental Awareness Tests, Gardner and Kleinke (1972) had (1) Knowledge of facts, (2) Knowledge of principles, and (3) Application as the behavioral components and (A) Pollution, (B) Population, and (C) Science, Growth of Technology and Ecological Relationships as the content dimension. More recently, Fleetwood and Hounshell (1976) used tables of specification for their cognitive test and their affective inventory. They utilized the taxonomies of the cognitive and affective domains developed by Bloom, et al. (1956) and Krathwohl, et al. (1964) for the behavioral dimensions. For their cognitive tests, the content dimension consisted of: (1) Ecosystems, (2) Natural Resources, (3) Pollution, and (4) Environmental Decision-making. The parallel dimension of this affective inventory included the following (A) Study of the Environment, (B) Conservation of Natural Resources, (C) Pollution, and (D) Politics and Policy Making for a Quality Environment. Specification of the abilities or traits to be assessed by a given instrument as exemplified by these two cases is one way in which improvement is facilitated.

As Swan (1971) and Bennett (1974) have cogently shown, research in EE can be aided by theories and methodologies from the behavioral sciences. Attempting to reconceptualize the ecological crisis, not as a technological problem but as a crisis of maladoptive behavior, Maloney, Ward, and Braucht (1975) have constructed a scale for measuring ecological attitude and knowledge. The scale consists of four sub-scales: Knowledge (factual knowledge related to ecological issues); Affect (degree of emotionality toward these issues); Verbal commitment (what a person states he is willing to do); and Actual Commitment (what a person actually does in reference to pollution-environment issues). Within social psychology, much activity currently centers on the "Locus of Control" research area as exemplified by the work of Rotter (1966). The Lunneborgs (1972) incorporated this dimension as part of their Environmental Assessment Survey. While I have not seen the results of their research, it seems to be a most fruitful area to pursue. This "Locus of Control" dimension is characterized by the two end positions: Internal Control (a person believes that events are contingent upon his own behavior) and External Control (a person believes things happen due to luck, chance, fate, and the control of powerful others or that things are unpredictable because of the great complexity of surrounding forces). Clearly, this theory has the potential of assessing a characteristic of people that may relate to their behavior (or non-behavior) with respect to environmental problems.

A questionnaire about pollution was designed by Rickson (1972) to analyze how "self-interest" affects individual's beliefs about facts and solutions with respect to environmental problems. Self-interest was defined in the narrowest sense assuming that "persons will choose that alternative which is the least costly to them personally." Sub-tests of items were related to the population explosion, automobile, industrial wastes, ocean oil spills, and atomic power. They hypothesized that students should respond negatively to items that require some basic change in their own perspective or behavior. "Self-interested people" should be reluctant to change their own behavior but agree that others, in this case industrial organizations, should change theirs. This research is an excellent example of the healthy symbiosis that can occur between environmental education and experts from other fields. Their theories and constructs may illuminate some of the myriad of issues that face environmental education.

A Q-sort methodology was utilized by Erickson (1971) to obtain attitude data

about one aspect of the environmental domain--wildlife. Eighty statements of opinion about wildlife had to be sorted into eleven piles representing various degrees of agreement and disagreement. Respondents were forced to distribute the statements into the eleven piles with a predetermined frequency which was based on quasi-normal requirements. Forty-nine people categorized as either Hunter, Wildlife Watcher, Farmer, or Other completed the Q-sort task. This type of data collection, if made less complex and involved, has great potential for collecting attitude data. Data obtained via this technique should be compared to data obtained in other ways. If no new information is gathered, it may not be worth pursuing, but it is possible this technique could elicit different types of information.

Relationships among attitudes toward the environment were investigated by Bart (1972) via his questionnaire composed of twenty statements representing positive ecological attitudes. A sample of one hundred graduate education students responded "Yes" or "No" to each of the items in the questionnaire. The response data were analyzed by the "tree theory" which produced a hierarchy among the specific attitudes based on the relative ranking of each attitude by the sample. The analysis suggested that a separation existed between personal and public ecological attitudes. Such information from more broadly based samples could provide additional information to aid in researching environmental education problems.

Watkins (1974) researched a very small domain within environmental education, but the methodology used makes his study worth discussing here. Ten Likert-type items related to attitudes about water resources were administered to over three hundred residents of two Florida cities (0.01% sample of the population) in two sessions separated by nine months. The data collected were analyzed via factor analysis and Guttman Scalogram Analysis. Five factors were obtained by the author and labelled: Willingness, Awareness, Knowledgeability, Rationality, and Economic Commodity. The five items that satisfied the Guttman scale criteria were subsequently called the "Water Concern Scale." Watkins suggested this scale should be interpreted in this manner:

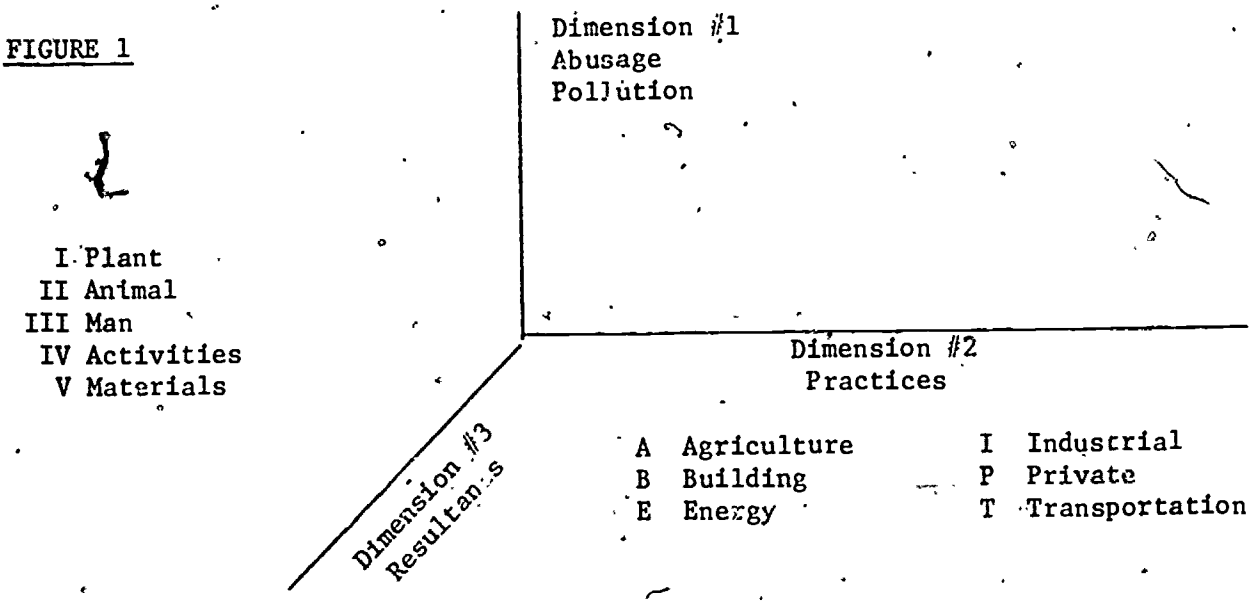
> "For those respondents who had given considerable thought to the water problem, it is acceptable to treat water reclaimed from waste as any other water, to accept the necessity of control over water exploitation and misuse, to believe that nature cannot solve supply problems before this becomes serious, and finally acknowledge that the solution of water resources problems is a matter with which they must personally concern themselves."

In addition, Watkins attempted to empirically validate the scale by comparing the scale scores with certain socio-economic variables which were hypothesized to be related to this environmental attitude. Such serious attempts to empirically validate our data-collecting devices should become a model for everyone.

Next, research has been done to attempt to measure "environmental values." The first task was encounted when wrestling with the simple task of defining the domain of environmental problems or crises. Traditionally, environmental concerns have been focused on specific problems or issues. They have been often listed or categorized as air and water pollution, land abusage, pesticides, natural resource shortages, and more recently things related to the energy crisis. Such categories do not appear to adequately represent all of the numerous and highly integrated complex environmental problems. We proposed a model which is more inclusive in its representation, and more flexible to meet changes of environmental concern. It is a three-dimensional model which categorizes environmental problems on the basis of their overall type, the practice

most closely related to the problem, and the general areas in which the effects of the problems are most noticeably felt. The diagram (Figure 1) summarizes the three dimensions and their components.

FIGURE 1



The following are brief descriptions of the categories of these environmental dimensions.

Dimension #1 Abusage - Pollution

There are two major types of environmental problems. One type may be called Environmental Pollution and the other type may be called Environmental Abusage.

Environmental Pollution - is putting excessive amounts of chemicals, gases, wastes, heat, noise, or radiation into the soil, water, or air.

Environmental Abusage - is the excessive removal or overuse of the environment's natural resources (water, land, air, minerals, metals, etc.). Abusage may occur through the complete destruction of a resource, changing the resources to an unusable form, or failure to reuse resources.

Dimension #2 Practices

Six major practices can be closely associated with environmental problems. These are:

A - Agricultural Practices - those things most directly related to farms and farming.

B - Building Practices - those things most directly related to the design, development, and construction of buildings.

E - Energy Practices - those things most directly related to and used in the production of energy or power.

I - Industrial Practices - those things most directly related to the industrial production of materials and goods (other than buildings, energy, or transportation vehicles and facilities).

P - Private Practices - those things most directly related to what individuals do at home or play.

T - Transportation Practices - those things most directly related to transportation vehicles (car, trucks, ships, trains, aircraft, etc.) and facilities (highways, airports, parking lots).

Dimension #3 Resultants

This third dimension refers to the general areas in which the effect of environmental problems may be felt. In three of these areas (I, II, III) the effect is classified as biological. In the remaining two areas (IV and V) the effect is classified as psychological. The term "resultant" is used to categorize all of the affected areas in that it is more global and it includes both biological and psychological effects.

I. Plant Life - those problems which most directly result in the harm or destruction of plant life.

II. Animal Life - those problems which most directly result in the harm or destruction of animal life.

III. Human Life - those problems which most directly result in the harm or destruction of human life or of items needed for human survival (such as food, air, water, etc.).

IV. Man's Activities - those problems which most directly result in the disruption or interference of man's work, play, relaxation, or other activities.

V. Man's Materials - those problems which most directly result in the loss, damage, or destruction of products, materials, or resources not directly needed for man's survival (such as buildings, clothing, property, materials, fuels, etc.).

In Dimension #1, environmental pollution has been given an equivalent representation with environmental abusage. It may be argued, perhaps justifiably, that pollution is in reality a form of abusage. However, due to the great amount of attention pollution has received, it was decided that pollution should be conceptualized on an equal basis with all other forms of environmental abusage. The "practices" dimension provides an element of flexibility within this proposed model. As various practices change with respect to environmental problems, the appropriate deletion or addition of categories can represent these changes. In Dimension #3. man is the central element upon which the resultants of environmental problems are felt. A strong or even equivalent representation of other forms of living organisms would be highly idealistic and quite naive.

Using this three dimensional model with its 2 x 6 x 5 matrix, one can begin to identify specific kinds of environmental problems. The total model represents sixty specific environmental problems.

The second major aspect of this proposed model deals with values and value criteria.

From a survey of the research literature related to values, the Allport-Vernon-Lindzey Study of Values (1960) was selected because of its potential for application to an environmental context. Five of the six categories used in the Study of Values (SOV) appear to be readily adaptable to environmental problems. The sixth SOV category, the Religious category, was eliminated from the proposed model because of the extreme difficulty in developing religious responses to environmental problems that were deemed appropriate and relevant to junior high school students. The five remaining Allport-Vernon-Lindzey categories of values (Aesthetic, Economic, Political, Social, and Theoretical) comprise the values dimension of our model. In order to integrate the environmental problems with the value responses, a situational component is required. This component sets the stage for student reaction to the problem and enables the response pattern to more closely parallel the original Study of Values model. One can construct options or responses to represent each of the five value criteria. Below is listed a sample item with its various components labeled. The three environmental components of the sample items along with the five value criteria are indicated.

PROBLEM	As there is an increase in the amount of cigarette smoking in confined areas, there will be an increase in the risk of lung cancer to the people of the area.	Dimension #1 Pollution Dimension #2 Private Practices Dimension #3 Human Lives
SITUATION	An an elected student council official assigned to deal with this program in your school, you should guide your conduct according to...	
VALUE RESPONSES	(a) The health and well being of others being affected by cigarette smoking	- Social
	(b) The ideals of beauty and appearance being changed by cigarette smoking	- Aesthetic
	(c) The enforcement of rules and regulations needed to control smoking	- Political
	(d) The information available from scientific research on the effects of smoking	- Theoretical
	(e) The amount of money wasted through cigarette smoking	- Economic

In his dissertation research, Sarnowski (1975) developed and validated an Environmental Value Inventory (EVI) useful with students of grade levels nine through twelve. After extensive field testing and revisions, a twenty-item form was administered to over five hundred students selected from the ninth and twelfth grade classes of three area schools (urban, suburban, and rural). In addition to analyzing hypothesized differences due to age, sex, and geographic residence, student

scores on the EVI were compared with their performance on a revised form of the Study of Values (1977). For a deeper analysis of the statistical findings, see the Sarnowski dissertation or related article by Baker, Doran, and Sarnowski (1977). For our purposes here, we concluded that the EVI was a valid and useful instrument for measuring environmental values at the grade levels nine through twelve.

As an extension of Sarnowski's work, modifications are presently underway to revise the EVI to make it useful with junior high students. The revisions include the following: (1) reducing the number of items from twenty to ten, (2) lowering the reading demands to appropriate levels, and (3) adding a visual element, via slides which represent each of the environmental problems. Through a sample of students across grade levels seven through twelve, we will attempt to find out how "environmental values" may vary with age, sex, and amount of science instruction. Via a brief questionnaire, we will collect responses to items designed to assess the "Locus of Control" variable.

The "State of the Art" with respect to the field reviewed here can best be described as embryonic. As the measurement cited here is all quite recent, this may be expected. The author's recommendation is that attempts be continued by experts from our field working with scholars from other fields, such as sociology, psychology, etc., to further the measurement devices in our field. The work of Swan and Bennett are excellent samples of this.

The largest task that faces the field is the eternal question of validity -- "what is it the instrument really measures?" It is easy to become complacent with the output from "empirical" studies -- reassuring reliability co-efficients and facades of factor co-efficients. But, an indepth inspection of each item of a given inventory is necessary to determine what is being assessed -- titles can be meaningless, even misleading. A prevalent procedure for developing instruments is to use "juries" of experts for selecting and/or validating a given collection of items. While such "expert" and "empirical" methods of developing and validating tests may be appropriate in some fields, my recommendation is to first develop conceptual schemes, tables of specification, even behavioral objectives. Upon this framework, one can make statements about an instrument's validity based on its relationship to expressed objectives and concepts. Eventually valid and reliable instruments will evolve which can be used as criteria for establishing the psychometric qualities of new instruments. Until such steps have been accomplished, it is recommended that one should scrutinize very closely every aspect of an instrument prior to its use. Instruments must be chosen which clearly measure an integral element of the environmental education program to be evaluated. The development of a pool of valid and reliable instruments for any field is a complex and difficult task, but essential to the stability and maturity of the discipline. It is my intention to continue wrestling with this problem and my hope that colleagues will also accept this challenge.

REFERENCES

Allport, Gordon W., Vernon, Philip E., and Lindzey, Gardner. The Study of Values. (Boston: Houghton Mifflin Company, 1960).

Baker, Milton R., Doran, Rodney L., and Sarnowski, Alfred A. "An Analysis of Environmental Values and their Relation to General Values." Unpublished manuscript (State University of New York at Buffalo, 1977).

Bart, William. "A Hierarchy Among Attitudes Toward the Environment." Journal of Environmental Education, Vol. 4(1): Fall 1972, pp. 10-14.

Bennett, Dean B. "Evaluating Environmental Education Programs," Chapter Seven, in Environmental Education by James A. Swan and William B. Stapp (New York: Wiley, 1974).

Bloom, B. S., Englehart, M. D., Furst, E. J., Hill, W. H., and Krathwohl, D. R. Taxonomy of Educational Objectives, Handbook I, Cognitive Domain. (New York: David McKay, 1956).

Doran, Rodney L. "State of the Art for Measurement and Evaluation of Environmental Education Objectives - 1976." Journal of Environmental Education (in press, 1977).

Erickson, Donald L. "Attitudes and Communications Abou Wildlife." Journal of Environmental Education, Vol. 2(4): Summer 1971, pp. 17-20.

Fleetwood, George R. and Hounshell, Paul B. "Assessing Cognitive and Affective Outcomes of Environmental Education." Journal of Research in Science Teaching, Vol. 13: 1976, pp. 20-35.

Gardner, Eric F. and Kleinke, David J. Syracuse Environmental Awareness Tests (Levels III, Forms A, B, C, and D). Developed for NEED, May 1972.

Helgeson, Stanley L. and Others. A Review of Environmental Education for School Administrators, Grant No. OE6-0-71-2732 (Washington, D. C.: U. S. Department of Health, Education and Welfare, Office of Education, December 1971).

Krathwohl, D. R., Bloom, B. S. and Masia, B. B. Taxonomy of Educational Objectives, Handbook 2: Affective Domain. (New York: David McKay, 1964).

Lunneborg, Patricia W. and Lunneborg, Clifford E. "Key for Environmental Awareness Survey (1972)." (Seattle: University of Washington Bureau of Testing, March 1972).

Maloney, Michael P., Ward, Michael P. and Braucht, G. Nicholas. "A Revised Scale for the Measurement of Ecological Attitudes and Knowledge." American Psychologist, 30: 1975, pp. 787-789.

Rickson, Roy E. "Self-Interest and Pollution Control." Journal of Environmental Education, Vol. 4(1): Fall 1972, pp. 43-48.

Roth, Robert E. "Conceptual Schemata in Environmental Management Education." Chapter Two in Processes for a Quality Environment, edited by Robert S. Cook and George T. O'Hearn. (Green Bay: University of Wisconsin at Green Bay Press, 1971).

Rotter, Julian D. "Generalized Expectancies for Internal vs External Control of Reinforcement." Psychological Monographs: General and Applied, Vol. 80 (1): 1966, pp. 1-28.

Sarnowski, Alfred A., Jr. Development and Validation of an Instrument to Measure High School Students' Environmental Values. Unpublished doctoral dissertation (State University of New York at Buffalo, 1975).

Swan, James. "Formation of Environmental Values: A Social Awareness." In Processes for a Quality Environment, edited by Cook and O'Hearn. (Green Bay, Wisconsin: University of Wisconsin, 1971).

Watkins, George A. "Developing a 'Water Concern Scale'." Journal of Environmental Education, Vol. 5 (4): Summer 1974, pp. 54-58.

Wheatley, John H. Affective Instruments in Environmental Education. (Columbus, ERIC Center, 1975).

TEACHING TOWARD PARADIGM SHIFTS: DEVELOPING TOMORROW'S ENVIRONMENTAL EDUCATOR

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Environmental issues are typically defined in terms of human values and are thus, in part, psychologically situated. This virtually assures that proposed solutions are bound by pre-established scientific perspectives (i.e., our existent views of psychosocial principles and the laws of natural science or ecology). What is often needed is a more dramatic shift of our knowledge paradigms such that both problems and solutions may be defined in other than an historical, or established, context. Such paradigmatic shifts come only from viewing both man and his relation to environment in radically new and unique ways.

The present paper explores teaching programmatics which are designed to develop students' abilities for viewing and understanding scientific issues from such altered perspectives. In addition, an empirical example illustrating one teacher-student generated perspective alternative is presented. This alternative views both man and environment as temporally structured co-existent systems which reciprocally affect one another's temporal parameters. By depicting environmental settings and events as discrete but changing phenomena, a measure of change rate in psychological environments may be established. When such environmental events change at a sufficiently rapid pace, behavioral flow rates change (i.e., accelerate or decelerate) in oscillation amplitude, phase, and reference level. Such a paradigm model is now being explored within the context of psychophysiology, stress, and education to better define psychologically healthful environments and organismic adaptation limits.

This paper is predicated upon the belief that environmental issues are essentially human issues. That is, questions of ecological imbalance reduce not only to questions of lasting human impact upon environment, but also to questions of dynamic interactions between man and environment. Thus, both man and his settings change, be those physical settings (e.g., potential changes in ambient and earth temperature resulting from ozone depletion), social intraspecies settings (e.g., concerns with overpopulation and concomitant problems of social stress, resource allocation, etc.), social interspecies settings (e.g., whale population depletions brought on by overhunting, or species survival endangerment by DDT residues, etc.), or personal settings (e.g., carcinogenic or narcotic abuse, predisposing aesthetic value orientations, etc.). In all of these categories, as well as others we might have mentioned, the problem results from the fact that man and his environment must be understood as co-functioning mutually adjustive systems (Ray & Brown, 1975; Ray & Ray, 1976; Ray, Upson & Henderson, 1977).

Such a position of course implies that modern environmental issues are then to be resolved only by considering man an integral part of both the issue and the solution. Assuming the absurdity of human genocide for the salvation of the natural order, the only alternative seems to lie in the alteration of man's behavior, be it through better technological application of the physical and

chemical sciences, better technologies in the psychological and social sciences, or, as is most likely, some combination of technological developments which focus on man, tools, and ecosystem impacts.

We believe that much of the necessary physical and social technologies, and, in fact, their scientific foundations, remain yet for future development and articulation. As such, the question is raised as to how one best educates ensuing future generations as to the necessary solutions that presently seem so vital, yet so elusive. How do we teach what we are yet to know without developing a serious defeatism or feeling of helplessness in our students? The remainder of this paper discusses an educational model for addressing this question. To make our strategy concrete, we will define and illustrate an exemplary "pure esearch" problem which evolved from our educational mode. We also venture to speculate as to potential technological applications of this example. But the central point is that of general educational strategy towards the advancement of knowledge generation versus mere knowledge perpetuation.

In 1970 T. S. Kuhn published a highly influential monograph in which he argued that science (and thus scientific technology) is largely a discontinuous process. The discontinuities in this process are related to the cultural nature of science. That is, we learn our science from preceding generations. But in learning what is known and how it is to be verified, we also learn to restrict our questions and scientific operations in subtle, but vital, fashions. Thus, we also learn from our teachers the "perspective" from which our knowledge is derived and from which it is to be evaluated. This tends to generate a massive conservatism in science as a social phenomenon. And, to teach students to appreciate problems that are presently without solution, while also teaching them to maintain a commitment to established conceptual perspective, may only ensure perpetual frustration in those students.

Only in relatively rare circumstances do scientists overcome their "perspectives" sufficiently to then generate entirely new scientific "paradigms," or ways of generating and verifying new knowledge. Examples of such events are to be found in Pasteur and Koch's view of sickness as a social interaction between micro- and macro-organisms, in B. F. Skinner's view of functional behavior contingencies in the ontogenetic evolution of human behavior, in Einstein's view of time space and mass as relative to the constancy of the speed of light, or in the many developments known collectively as quantum mechanics. From such dramatic new laboratory research perspectives came the radically unique and important technologies of modern medicine, human behavior modification therapies, and nuclear engineering.

But how does one educate in favor of such genius or insight? How do we pass on the knowledge of today without impeding the discoveries of tomorrow? How do we accomplish this especially in the face of mass education which must also serve the needs of an educated consumership? More relevant perhaps to environmental topics, how do we accomplish this with students bent primarily on practical solutions, as opposed to fundamental, or "basic" research?

To the present authors, several issues seem crucial to the solution of our dilemma. First, students must come to understand first hand; i.e., through process-oriented education, the relations which exist between "pure" and "applied" science. Secondly, students must learn to project unique perspectives into their laboratory and practical experiences while also learning the fundamental information and dictums governing science and investigative labor. Finally, students must learn to experience science as a human phenomenon; a complex phenomenon

consisting of specialized literatures, fiercely defended values, socially defined rejections and acceptances, and, perhaps most of all, of personal joys and depressions. We have endeavored to develop such a teaching model for the science of psychology, but we sincerely believe it applies to virtually all scientific and scholarly disciplines, including, or we should say, especially, such interdisciplinary programs as environmental education.

To make our abstractions concrete, we will offer our own programmatics as an example. Essentially, we view specialized undergraduate college education (i.e., the major) as developing the student through three phases, which, although not highly differentiated from one another in reality, are instructive abstractions nonetheless. The first phase may be called the "Introductory Cookbook" phase. The second may be called the "Scholar's Apprenticeship" phase, and the third, the "Creative Exploration" phase.

Our initial teaching endeavors are aimed at teaching students about the very process of learning and discovery simultaneously in the abstract and the personal-behavioral sense. The goal at this stage is to teach students to control their own learning processes, and, in fact, such control is ultimately required as a manifestation of their success or failure (i.e., it is our test). This stage is viewed as serving majors and non-majors alike equally as well, since, for example, students not only experience the differences between recognition, recall, and structural association (i.e., thinking) in reference to their classroom and text materials, but they also learn to label and identify each of these dimensions of the learning process. As such, they learn to control the learning process itself. In addition, beginning students experience differences between relying on cues and prompts in performance of learned skills, such as is the case upon recognizing relevant materials when nested within irrelevant materials (the typical format of multiple choice exams), versus acquired independence from prompts and cues (as is the case with abstract essays or impromptu speeches). Likewise, differences between written forms of behavior (as is required by most tests but few real life situations) versus actual utilization of material in real life applications, laboratory probes, or autobiographical explorations are required.

Our primary goal at this stage is to start with a "cookbook" manifestation of vocabulary and conceptual materials that first allow the students to generate their skills with a great deal of initial prompting and support, but to then gradually wean them from the use of supports until they have sufficient fluency to demonstrate true applied understanding in more generalized and ecologically valid situations.

When this is taking place, students are manifesting skills in personal growth and competency in the very subject matter of personal growth and competency. When they have begun to accomplish skill in applied vocabulary and elementary principles, students are then encouraged to mix upper division courses and independent research or internship studies. Upper division courses focus specifically on abstractions and relationship recognition (i.e., the courses are designed to teach the student development of his own comparative and evaluative resources in service of the thinking and idea construction process by relying on relatively extensive overviews of existent topically organized scientific literatures). Independent studies focus more on laboratory applications of those creative thought and evaluation processes. At this intermediate level, students are often "apprenticed" to more advanced students who have more fully developed and sophisticated research skills.

These more advanced students are thus learning in two ways; they are learning creative exploration in their own studies while also learning through the teaching of what they know -- a process we all recognize as requiring the utmost in our own conceptual development relative to what we are teaching.

The more abstract and creative accomplishments are realized by having advanced students research questions which are almost exclusively methodological (as opposed to problematic) in character. By this strategy of researching methodology, we attempt to teach the student the essentials of "perspective" and "paradigmatics" while also teaching him the more mundane requirements of research, such as the utility of instrumentation, the mechanics of data reduction and analysis, and the skills of literary articulation. As such, we strive to teach our students fundamental skills and understandings as they relate to the scientific process when defined in its most creative skills necessary to overcome paradigmatic restrictions by teaching research skills important for changing paradigmatics.

Thus, the specific focus of the most advanced level is the development of the individual by encouraging the student to participate in, and pursue studies of, an independent nature. In fact, we currently require a minimum of two terms of independent study for all of our majors. The general benefit of this program is that it allows for questions of a truly original and often interdisciplinary nature to be raised while also allowing for the development of a high degree of sophisticated academic inquiry.

This focus on creative methodological exploration manifests itself both in instructional method and the production of student-generated professional papers. Since 1971, approximately forty percent of the graduating senior psychology majors have co-authored and/or presented at least one paper at a national or regional professional meeting. Several students have had multiple papers and one student has co-authored two journal publications. Such activities are instrumental in developing appreciations for the more subtle literary and social aspects of sciences and knowledge.

Teaching methods in virtually all our courses have utilized the model of independence and student research until it has become a germane portion of the classroom instructional procedures as well. Both in terms of scientific methodology and educational philosophy, the focus is on the inductive method. The faculty member, in concert with his students, pursues a data-based orientation to process, as opposed to content, education. The underlying assumption upon which we are operating is that education provides the means for continued inquiry and constant evaluation of knowledge.

Perhaps we can illustrate this process more graphically by describing a senior-level project which evolved from this educational strategy. We have chosen a singular project by a former undergraduate student which is especially of interest because of its potential relevance to environmental questions.

A major portion of the lower division courses which this student experienced focused on issues of organismic stress (Selye, 1956). Or more specifically, they focused on concerns with overpopulation and "Future Shock" (Toffler, 1970) as stress factors, and with psychological-environmental systemics as the organism adapts to these factors. The unique element introduced into the investigation was the view that physical and social environments are temporal events, and that their effects on biological organisms may also be temporal in nature.

Thus, our student postulated that a major animal-environmental interface problem

might be the rapidity of change in the organism's environmental settings. The problematics of this at the human level are those general discomforts and biological stresses experienced as the pace of living in today's constant, changing world. That is, the problem seems to be in the temporal organization of behavior as it evolves from particular temporal organizations in environmental flow. Both environments and biological organisms are thus viewed as systems organized in time.

But we had to ask, what is it that is temporally organized? What could we measure? We approached this problem by defining environmental-informational "states" which change across time. Likewise, we identified behavioral "states" in experimental animals that change across time.

The laboratory analog arrived at relied on the time-honored laboratory rat and his ability to learn lever pressing to obtain water when he is thirsty. If the subject is rewarded for lever pressing only in the presence of a particular environmental state, say a brightly lit experimental chamber, then he quickly learns to press levers only during the duration of that particular environmental state. If alternative environmental states exist where lever presses are not rewarded, say a dimly lit experimental chamber, then the animal learns to discontinue his lever pressing and proceeds on with other behavioral states such as grooming, exploring, moving about the chamber, resting in a corner, etc. When the brightly lit conditions are reintroduced, the anim quickly runs to the lever and continues pressing and drinking.

Thus, we have an animal which assumes a variety of behavioral states dependent upon the character of the environmental states. In this case, the animal lever presses and consumes his water in brightly lit environments, and he discontinues these behaviors in favor of an array of other behavioral states, such as exploring, moving about, grooming, resting, etc., in dimly lit environments. To draw an analogy, he recognizes his conditions for working (a brightly lit chamber means perform lever presses) and his payoffs (water) and discriminates these from his conditions for leisure (dimly lit chamber) where there are no work payoffs and he can return to his natural flow of behaviors (i.e., resting, grooming, etc.).

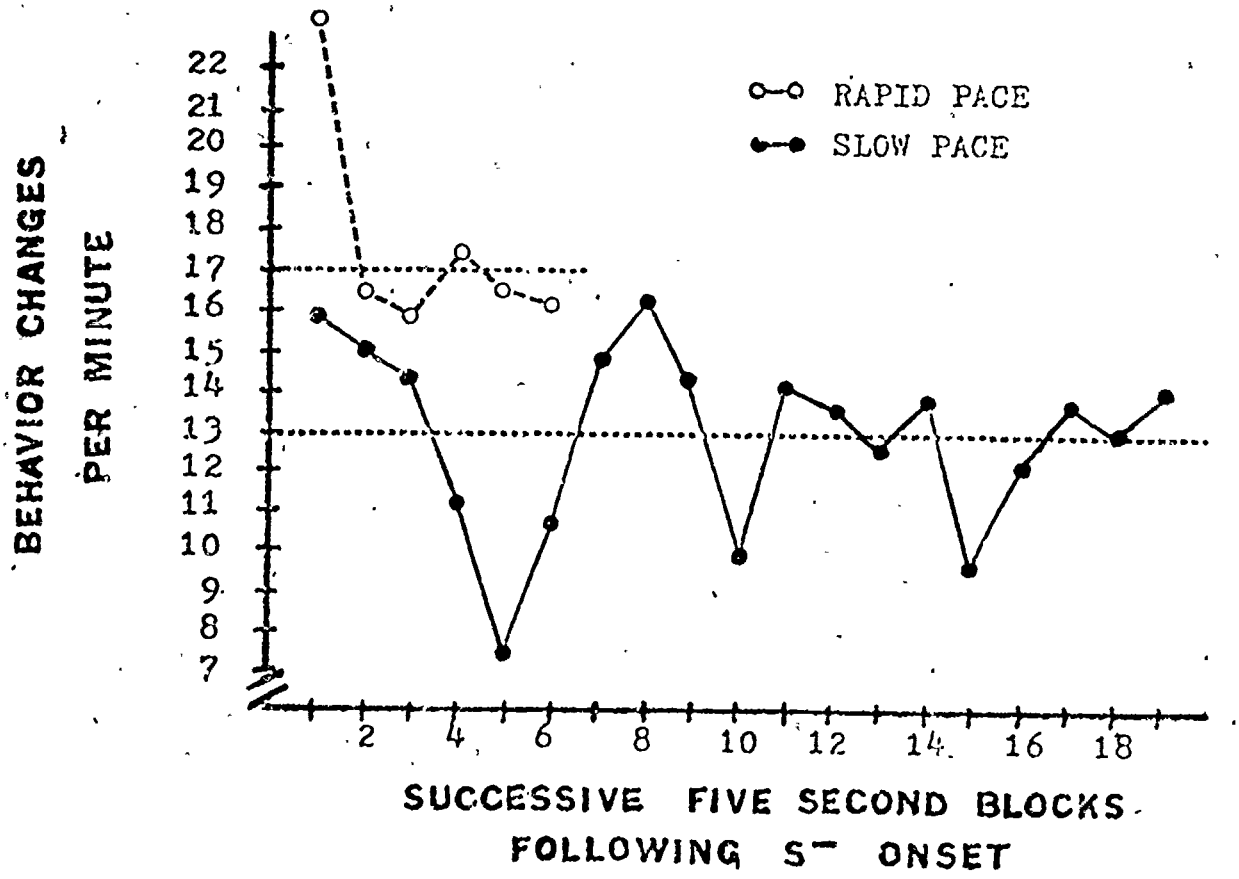
Now, what if we pace the environmental conditions by alternating work and rest conditions more rapidly or more slowly? This would be analogous to pacing our own work and rest schedules. Or even perhaps analogous to pacing the crucial events <u>within</u> a working schedule. If the animal experiences a change in his own "pace of life," we might expect him to speed or slow his behavioral changes in response to the pace of environmental change.

Figure 1 illustrates the behavioral changes that take place across successive five-second time periods within the "resting" (S-) condition when these resting conditions are paced rapidly (i.e., 15-85 seconds duration for work and for rest periods, $\bar{X}$ = 18.5 seconds) and when paced more slowly (i.e., work and rest periods are each four times longer duration than in the rapid pace).

Animals in rapidly paced setting conditions changed their behavioral states seventeen times per minute on the average. They changed most rapidly during the very first seconds after rest periods began and systematically slowed their rate of behavioral change throughout the remainder of the rest interval. Animals in the slow-paced conditions changed behavioral states only thirteen times per minute and tended to oscillate regularly in their pace of behavioral change across the rest intervals. Mathematical models of these damped decay and oscillation phenomena show them to be reliable phenomena with real mathematical properties (see

FIGURE ONE

Average changes in behavioral flow rate during each successive five-second block following S- (rest perioe) onset and continuing until the average S+ (work pericd) onset.



Ray, Upson, and Henderson, 1977).

What do these data suggest? They suggest that temporal parameters of environment are extremely important determinants of temporally organized biological conditions. They suggest that the pace of life we all experience may well be quantified and investigated in relation to the pace of environmental changes we live with. Their potential implications for understanding environmental and social contributions to health and stress-related disease are enormous (see Selye, 1956; Moss, 1973).

In addition, we are presently conducting research to evaluate the significance of self versus other paced control over the environmental flows. The long-range interest is to offer alternative perspectives on student control versus teachers' control of instructional pace in college curricula.

Most significantly for our present discussion, these data suggest that undergraduate students can learn to create highly novel perceptions of environmental and other scientific issues, and they can carry through on these in remarkably insightful ways to generate clear demonstrations of newly-emerging paradigmatic perspectives. We would like to suggest that this is what tomorrow's environmental education should be all about.

REFERENCES

Kuhn, T. S. The Structure of Scientific Revolutions. (Chicago: The University of Chicago Press, 1970).

Moss, G. E. Illness, Immunity, and Social Interaction: The Dynamics of Biosocial Resonation. (New York: John Wiley & Sons, 1973).

Ray, R. D., and Brown, D. A. "A Systems Approach to Behavior." The Psychological Record, 1975, pp. 459-478.

Ray, R. D., and Ray, M. R. "A Systems Approach to Behavior II: The Ecological Description and Analysis of Human Behavior Dynamics." The Psychological Record, 1976, pp. 147-180.

Ray, R. D., Upson, J. D., and Henderson, D. J. Manuscript submitted for publication, 1977.

Selye, Hans. The Stress of Life. (New York: McGraw-Hill, 1956).

Toffler, A. Future Shock. (Westminster, Maryland: Random House, 1970).

PSYCHOLOGICAL READINESS AND ENVIRONMENTAL EDUCATION

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A vast array of Environmental Education (EE) courses has emerged over the past ten years. These courses have outlined the concepts underlying Environmental Education and/or advocated a process relevant to the teaching and learning of EE. While these elements are important, it is significant that little attention has been paid to the cognitive abilities of children in designing EE programs. If children are to genuinely learn about EE, it is mandatory that the course curricula include activities, materials, and concepts that the child has the ability to grasp.

Many researchers have concerned themselves with the intellectual development of the child. One of the foremost contributors to this field is Jean Piaget, an eminent Swiss psychologist who, over the past fifty years, has intensively studied children and developed a complex theory of intellectual growth. Piaget's research into children's thought has important implications for the teaching of Environmental Education.

According to Piaget, intelligence is a general human capacity and thinking is manifest in all of an individual's actions, experiences, images, etc. A distinction is made between the development of intelligence and learning. Intellectual development is the acquisition of the structures of action and thinking, while learning involves the attainment of specific skills and can only occur when the individual possesses the appropriate mental structures.

Piaget recognizes four factors that influence mental development:

1. physical maturation
2. experience
3. social interaction
4. equilibration

The first three factors are self-explanatory. However, equilibration is a difficult concept concerning the function of intelligence. In Piagetian terms, adaptation is the essence of intellectual functioning. It is broadly defined as the change brought about in an individual as a result of interaction with the environment (Ginsburg, 1969, p. 24). This involves the tendency to organize one's perceptions and experiences into stable and coherent structures. Adaptation is normally described in terms of the twin processes of accommodation and assimilation. Assimilation is the incorporation of experience, perceptions, etc., into already existing mental structures; whereas accommodation involves the individual's alteration of mental structures to suit new situations.

Equilibration is the tendency of the individual to strive for a mental balance between assimilation and accommodation. In other words, the individual seeks to attain an equilibrium between what he understands and what he experiences. Coupled with this is the notion that the child has an intrinsic desire to know and therefore is always interacting with the environment in the search for answers that satisfy. These ideas are central to Piaget's theory and he states that "development is a progressive equilibration from a lesser state to a higher state of equilibrium" (Pulaski, 1971, p. 9). Any level of equilibrium is disturbed by new situations or information resulting from physical maturation, experience, and social interaction. Development then, is the remaking of mental structures that permit the individual to cope with increasingly complex information.

Piaget's intense observation of children has led to a far more detailed analysis and explanation of children's intellectual development than can be covered in a paper of this scope and length. However, some of his observations and insights which are particularly relevant to EE deserve attention.

Piaget has shown that the child's view of the world and mental capabilities greatly differ from those of an adult. The child develops the mental operations of an adult by progressing through a series of stages, each of which is characterized by a particular type of mental ability. These stages are hierarchical in order and occur in an invariant sequence. Children pass through these stages at different ages and may exhibit a degree of overlap; i.e., the child may function at a higher level of development in one instance, and at a lower level of development in others. Hence, the child progressively constructs and reconstructs his model of reality until it approximates an adult's model. Piaget has identified these stages and offers a rich description of the child's optimum capabilities in each stage of development.

Piaget's four major states of cognitive development are:

1.	sensory-motor	0-2 years
2.	pre-operational	2-7 years
3.	concrete operational	7-11 years
4.	formal operational	11+ years

Intellectual activity in the sensory-motor stage is evidenced by the child's sensory perceptions and motor activity. The infant is highly egocentric; i.e., he is unaware of anything beyond himself. The ability to anticipate events, to imitate, and to realize that an object exists even though he cannot see it (object constancy) develops.

In the pre-operational stage the child conceptualizes on a mental level what he grasped at the physical level in the sensory-motor stage. For example, the pre-operational child exhibits a high degree of mental egocentricity but has lost the physical egocentricity characteristic of the sensory-motor period. Mental egocentricity is manifest in the child's inability to appreciate another person's point of view. Pre-logical reasoning that relies on perception emerges, but the pre-operational child cannot recall something that has been said earlier. The child's ability to communicate and cooperate with others is limited.

The concrete operational stage is so named because the child is restricted to thought concerning concrete objects as opposed to thinking in abstract or hypothetical terms. The dependency on perception is greatly diminished and the child is capable of first order operations. The ability to think forwards and backwards develops, and the logic of classes and relations emerge. Thus, part/

whole relationships and rankings have meaning for the child. The principle of cognitive conservation begins to emerge here as well. This involves the recognition that characteristics of a substance remain constant despite changes in the appearance of the substance. Early in the concrete operational stage (seven years) conservation of continuous quantity and substance are obtained, while conservation of weight and volume follow later (nine-ten years).

In the formal operational period the child can perform second order operations and engage in abstract, hypothetical thought. Metaphors and similies have relevance for the formal operational child as do expanded concepts of space and time. This stage is marked by the ability to solve multi-variable problems in a systematic manner.

Characteristics of the concrete operational child are particularly relevant to the teaching of EE. This stage is used because it is one which most children will pass through during their primary education years. The examples cited below are offered with the premise that the school should provide an environment in which the child's present skills and capabilities are exercised and the attainment of a higher level of learning is encouraged.

The concrete operational child's predominant characteristic is his ability to apply logic only to concrete objects. The obvious implication for teaching is to make maximum use of concrete materials. Related to this is the need for an activity-oriented approach. By allowing the child to "do" and utilize all his senses, the link to the concrete world remains strong. Environmental problems that are readily observable provide ideal topics for study (i.e., schoolyard litter). As the child is unable to engage in hypothetical thought, consideration of ethics and values should be underplayed.

Egocentricity is characteristic of this stage. The child cannot appreciate other points of view; therefore, his own experience or personal relationship with the environment should be stressed. Study should focus on the local level, as the child's concept of scale and his relationship to the world in general are not well developed. Children can learn to recite environmentally sound rules (e.g., anti-litter propositions), but in many cases will see no harm in the individual act (of littering) as "only a bit of pollution." Questions such as how much and what kind of waste does one student or the class produce could easily be examined.

Another characteristic of the concrete operational child's egocentricity is animism. This involves the belief that inanimate objects are alive and conscious. When the child is in the concrete operational stage, objects that move (i.e., clouds, sun) are attributed with life. Later, only objects that move spontaneously (i.e., cars, bicycles) are seen as animistic. It is only around eleven-twelve years of age (period of formal operations) that exclusively plants and animals are seen as alive. Whereas adults commonly use such terms as "dead batteries," "live wire," "dead matches," etc., egocentric children do not understand them and are prone to take them literally. Since children readily accept fantastic and magical explanations of events, it is imperative that teachers avoid animistic references and make sure that their pupils truly comprehend EE relationships and causes.

Another common manifestation of the child's egocentricity is the out-of-sight out-of-mind mentality. For example, concrete operational children have difficulty relating to such problems as solid and liquid waste disposal. In their view once the toilet is flushed or the garbage picked up, there is no "problem." Approaching these issues requires field trips, in-class modeling and experiments, and constant reference to the child's role in the system.

The concrete operational child comprehends the logic of classes. He is capable of constructing groupings, adding and multiplying among those groupings, and understanding part/whole relationships. Hence, projects that involve collection and identification are appropriate. Observation and recording abilities would also be exercised through such activities. The biological concepts of communities and associations would be appropriate for concrete operational children, if presented in a very simple manner.

Certain properties of number are within the grasp of children in this stage of intellectual development. Therefore, activities involving simple measurements would be appropriate. Various pollution indices lend themselves well to such tasks. For example, the detection of SO_2 in the air can be a fairly simple procedure.

Colormetric schemes such as the use of methyl blue to indicate the presence of O_2 are particularly useful. The child can understand and repeat the experiment to his satisfaction. The teacher should provide a simple factual explanation to eliminate the magical element of the procedure.

In reference to experiments it should be recognized that the concret operational child can envision alternate paths of action, but does not have the mental structures to permit truly systematic testing. Hence, elaborate experimental methods and general theoretical principles should be avoided.

The ability of the concrete operational child to use the logic of relations means that the child can construct series and nested classes. Activities structured around the food web would be relevant. The problem of non-biodegradable substances would be appropriate once the conservation of continuous quality and substance are attained by the child.

Elaborate experiments involving substance transformations should be avoided until the child appreciates the conservation of weight and volume (nine-ten years). The ecosystem concept can be understood at a very basic level by the concrete operational child. Relationships between the elements of the child's own environment should be explored. However, attempts to extrapolate local examples to a global scale should be avoided.

Language becomes more meaningful for children in this stage. Hence, they are better able to communicate and cooperate with one another. The child still grapples with the problem of articulating his thoughts. Vocal communication, particularly in the form of argumentation, should be encouraged to assist the child in developing language skills. Debates dealing with localized issues would be appropriate.

To date, EE programs have not been designed to correspond to the cognitive abilities of the student. Considering the body of knowledge regarding children's intellectual capabilities, this situation exists to the detriment of EE courses especially for children in the primary and elementary grades. A union of these two fields would produce higher quality and more effective EE programs. It is essential that children today participate in EE courses, but if the message is not presented at the right time and in an appropriate manner, the ultimate goal of "educating tomorrow's parents, teachers, and leaders" is dealt a serious blow.

REFERENCES

Charles, C.M., Teachers Petit Piaget. (Belmont, California: Fearon Publishers, 1974).

Elkind, D., Child Development and Education. (New York, New York: Oxford University Press, 1976).

Furth, H.G. and Wachs, H., Thinking Goes to School. (New York, New York: Oxford University Press, 1975).

Ginsburg, H. and Opper, S., Piaget's Theory of Intellectual Development. (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1969).

Pulaski, M.A. Spencer. Understanding Piaget. (New York, New York: Harper and Row, Publishers, 1971).

DEVELOPING A UNIQUE ENVIRONMENTAL EDUCATION PROGRAM

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> When analytic thought...is applied to experience, something is always killed in the process. That is fairly well understood, at least in the arts. Mark Twain's experience comes in mind, in which, after he had mastered the analytic knowledge needed to pilot the Mississippi River, he discovered the river had lost its beauty. (Pirsig, 1974, p. 77)

It is convenient and effective to categorize environmental education programs as having either a biological approach or a resource management approach (Shaeffer, 1975, p. 1). Such a dichotomy, though helpful, informative, and universally accepted, can be misleading. Environmental education is certainly indebted to biology and to all the sciences, biological and social, that compose resource management. But the roots of environmental education lie deeper than science education and for their nutriment require a completion most easily derived from that branch of human experience so boldly described as "Humanities".

It is obvious that most undergraduates who choose forestry as their undergraduate major do so because they are attracted to the woods and the great outdoors. But in the course of four years, something happens. Perhaps as a result of studying Dendrology, Silviculture, Forest Ecology and Mensuration, that love for the outdoors is replaced by the approach of the statistician and accountant. The one-time lover of the outdoors returns to the woods, hard-hat in one hand, pocket calculator in the other, and sees oak trees in terms of diameter breast high, and leafy boughs as forest canopy limiting growth of the shade-intolerant species. Seeing the changes in attitudes in a short space of time is a disconcerting experience.

From all the literature dealing with the interrelationship of the sciences and the humanities, few writers have been as lucid as Alfred North Whitehead, who retired from a chair of Mathematics to accept a chair in a Philosophy Department. In his book, The Aims of Education, Whitehead (1949) asserts that all education passes through three stages:

Romance
Precision
Generalization

Learning begins when the imagination falls in love with something--when an object of contemplation causes enough delight that the learner is drawn again and again to dwell upon that object. This stage Whitehead calls "Romance", for this word signifies attraction, allure, longing to be with an object of apparently insatiable curiosity. The "Romance" of a sexual attraction is a case in point: We are attracted to the unknown, the mysterious, the provocative. (This is not to suggest that one cannot find the familiar provocative. The familiar has its own style of novelty and mystery. We might invert the French adage that the more a thing changes, the more it remains the same: "the more a thing remains the same, the more it changes"). So, too, says Whitehead, the love of learning is the

basis of all education: that powering hunger to put oneself in the midst of the unknown. Basking in the mysterious is not enough, however, for we long to become more precise about the object of our love. When we fall in love with someone, we cannot gather enough details of that person's background, neighborhoods, schooling, natural history. So, too, in knowledge of the world, we enter a stage of "Precision", a time of exact measurement, careful observation, prediction, verification. It is in this second stage that we are scientists.

Generalization. The scientific vision must give way, says Whitehead, to a deeper vision, characterized by the mind-set of "Generalization". Here the [illegible]ionary goes beyond science to see the wider application of knowledge and [illegible]es to grasp the humanitarian and social implications. Very important to understanding Whitehead's vision here is the stress placed upon the fact that each level requires the continued application of the preceding level rather than the replacing or eliminating of it.

Environmental education is too easily relegated to the sphere of precision, sometimes to the realm of "teaching science in the outdoors". As Roderick Nash phrased it, "Another challenge Environmental Education must face in the future is to stem the gradual erosion of environmental studies into environmental science" (Nash, 1976, p. 5). I think it is not so much an erosion as a constant tendency for that which enjoys a certain cultural dominance to assume absolute monarchy--a sort of "manifest destiny" performance. The students we attract to environmental studies are probably not much different from forestry majors: They come because they are romatically attracted to the environment. In the decade of the seventies, many of them have just found the world, found it an immensely attractive, but severally endangered, environment.

Environmental studies must never lose that element of attraction, allure, of dealing with the mysteriousness of nature in all her seasons and all her vagaries. It must, of course, be scientific, for we have the opportunity to be precise and accurate in our observation, to be able to predict consequences of rearranging nature, and to be protective and solicitous of the environment in ways that only science will allow.

The stage with which environmental educat[illegible] should be primarily [illegible] is Generalization, for it is in environmental [illegible]udies that we most clearly [illegible] with policies and management, with wise use and practical preservation. As Pettus said: "The goal of environmental education is to bring about informed environmental policies for society which will be compatible with the maintenance of a suitable planetary environment" (1976, p. 48). Full scale programs which follow this pattern are best exemplified by the graduate program at the University of Michigan, where precise nature knowledge is allied to the study of such fields as law, political science, and sociology.

Precision. If one were to level a broadside criticism at current environmental education programs, it would be that precision is overemphasized to the detriment of appreciation (romance) and application (generalization). Precision is only valuable if it increases appreciation. It is so easy to make precision an end in itself, to make cataloguing and identifying the goal, rather than the means to increased appreciation. Whitehead rejuvenates the vision of the romantic poets who had an intense appreciation of nature and generalized that appreciation from the particular (one impulse from a vernal wood) to the universal (of moral evil and of good). Perhaps Blake's Auguries of Innocence does it best of all:

To see a World in a Grain of Sand
And a Heaven in a Wild Flower,
Hold Infinity in the palm of your hand
And Eternity in an hour.

Summer Nature Studies

At West Virginia University, an attempt was made to put together a program that would embody these ideals. A number of people in the College of Arts and Sciences had displayed an ardent interest in the environment and a few had indicated a willingness to collaborate with a professional school in undergraduate education. It appeared, however, that if we were to emphasize the romance or attraction of the countryside, the English Department would be our best bet. And indeed, we found a professor of poetry who was quite interested in nature poetry and felt that his own education in the natural sciences could benefit from such exposure to the outdoors. From our own faculty we chose an interpretive naturalist, a social scientist interested in studies of perception, and the resident humanist. The program is conducted in June at the University Biology Station at Terra Alta in rural Preston County. At the present stage of development we are stressing the "Romance of Nature" aspect, with a study of the prose and poetry characteristic of the romantic attraction to the outdoors. Nature walks are conducted by poet and scientist, with more emphasis placed on the enjoyment aspect of existence in the woods than on learning taxonomy and nomenclature.

Programs such as this are dependent upon the level of sophistication of the clientele. Many people who apply to the program are really looking for an elementary conservation course or basic field biology course. These things have been done before and done very well. While our program is elementary enough that n one will be "outclassed" by the discussions and discoveries, the program presupposes the kinds of exposure to science and literature that most college graduates have. The pedagogy behind the program tries to walk a tightrope between "all learning is self-learning, all discovery is self-discovery" and "in order to appreciate or generalize, one must know the facts".

In the future, we intend to seek support for the program by including it in an adult "Forest Industries" Camp, where steering a course between "romantic" and "classic" may be much more difficult. A program such as this, however, could be reduplicated in many ways at many different levels. In a high school program, it could justify the inclusion of an outdoors-oriented English teacher. In grade school the need to express what one has felt in exposure to the world of nature lends itself very easily to the writing of poetry or brief passages of descriptive prose. At any level, it can help the participants to be articulate about their grasp of man's place in nature.

In this paper I have tried to follow Whitehead's suggestion by presenting some of the Romance and Precision of the developing of one environmental education program. I should like to complete the triad by offering a few appropriate generalizations. First of all, I believe we miss a large and potentially influential audience by not orienting some programs to people beyond the college years. The West Virginia Department of Natural Resources offers spring and fall weekend nature walks, and they are persistently oversubscribed. The average age of participants is slightly over forty, with a large number of retired people being included. Several different hikes are planned so that people can pit their ability against the level of difficulty they feel comfortable with. A naturalist offers some background the first night, and the

Department of Natural Resources personnel put on an educational-cum-entertainment program the second night. A naturalist is the leader of each hike, and people seem to seek out companions of similar interests and curiosities.

I think we also miss the boat when we are too narrowly scientific. I have been pleasantly surprised at the knowledge of music and poetry possessed by some of West Virginia's renowned naturalists. For many of us, the movement into the scientific world is movement that leaves behind the gushiness or emotionality of poetry, music, or the arts generally. But as Whitehead says, science is only one means of coming to grips with reality. Emotion, Romance, and Intuition are also means of finding outselves at home in the real.

As a final illustration of Romance, Precision, Generalization, and Environmental Education, let me end with an anecdote and a poem. A group of West Virginians who had followed the Monongahela Forest Controversy with some care took a number of field trips and read a number of articles on clear-cutting and select-age cutting as forest management techniques. They appreciated the beauty of a forest, the majesty of hundred-year old oaks, and they understood the economics of forest management well enough to accept timbering and even clear-cutting as sad but comprehensible necessities. Nothing expressed the sentiments of the group better than the following poem by Gerard Manley Hopkins, entitled "Binsey Poplars". I would never attempt to explain or defend clear-cutting without somehow purging my emotions of sadness at the action by reading or reciting this poem:

My aspens dear, whose airy cages quelled,
Quelled or quenched in leaves the leaping sun,
All felled, felled, are all felled:
Of a fresh and following folded rank
Not spared, not one
That dandled a sandalled
Shadow that swam or sank
On a meadow and river and wind-wandering wee-winding bank.

O if we but knew what we do
When we delve or hew--
Hack and rack the growing green!
Since country is so tender
To touch, her being so slender,
That, like this sleek and seeing ball
But a prick will make no eye at all,
Where we, even where we mean
To mend her we end her,
When we hew or delve:
After-comers cannot guess the beauty been.
Ten or twelve, only ten or twelve
Strokes of havoc unselve
The sweet especial scene,
Rural scene, a rural scene,
Sweet especial rural scene.

REFERENCE

Nash, Roderick. "Logs, Universities, and the Environmental Education Compromise." Journal of Environmental Education, 7(1):2-11, 1976.

Pettus, Alvin. "Environmental Education and Environmental Attitudes." Journal of Environmental Education, 8(1):48-51, 1976.

Pirsig, Robert M. Zen and the Art of Motorcycle Maintenance. Bantam Books: New York, 1974.

Pratt, Arden L. Selected Environmental Education Programs in North American Higher Education. Published by National Association for Environmental Education, 1974. 142 pp.

Shaeffer, John. "Approaches to Environmental Education." Journal of Environmental Education, 7(3):1-4, 1975.

Whitehead, A. N. The Aims of Education. Mentor, New York, 1949.

THE RELATIONSHIP BETWEEN EXPERIENTIAL LEARNING, PERCEPTION, AND INFORMATION PROCESSING

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Environmental Education's methodology has parallelled the development of basic science education techniques with the historical sequence of

1. identification
2. collection
3. experimentation
4. exploration
5. observation, and finally,
6. experiencing or acclimatization (Van Matre, 1972).

The significance of this "hands-on" experience is demonstrated by the choice of our pre-conference topic, "The Role of Experiential Learning in Undergraduate Environmental Education." The main concerns of experiential learning and undergraduate environmental education need to be viewed in terms of other major learning variables. Martin pointed out a weakness in the field of Outdoor and Environmental Education when he commented that "frequently, we make the assumption that the activities, the mode or setting of teaching are the sole variable of significance" (1975:136). Learning is a complex process of social, psychological, and environmental interaction.

What are the processes and important variables that affect the end product of an educational program? The communication process, the perceptual process, and information processing are affected by the learning parameters of

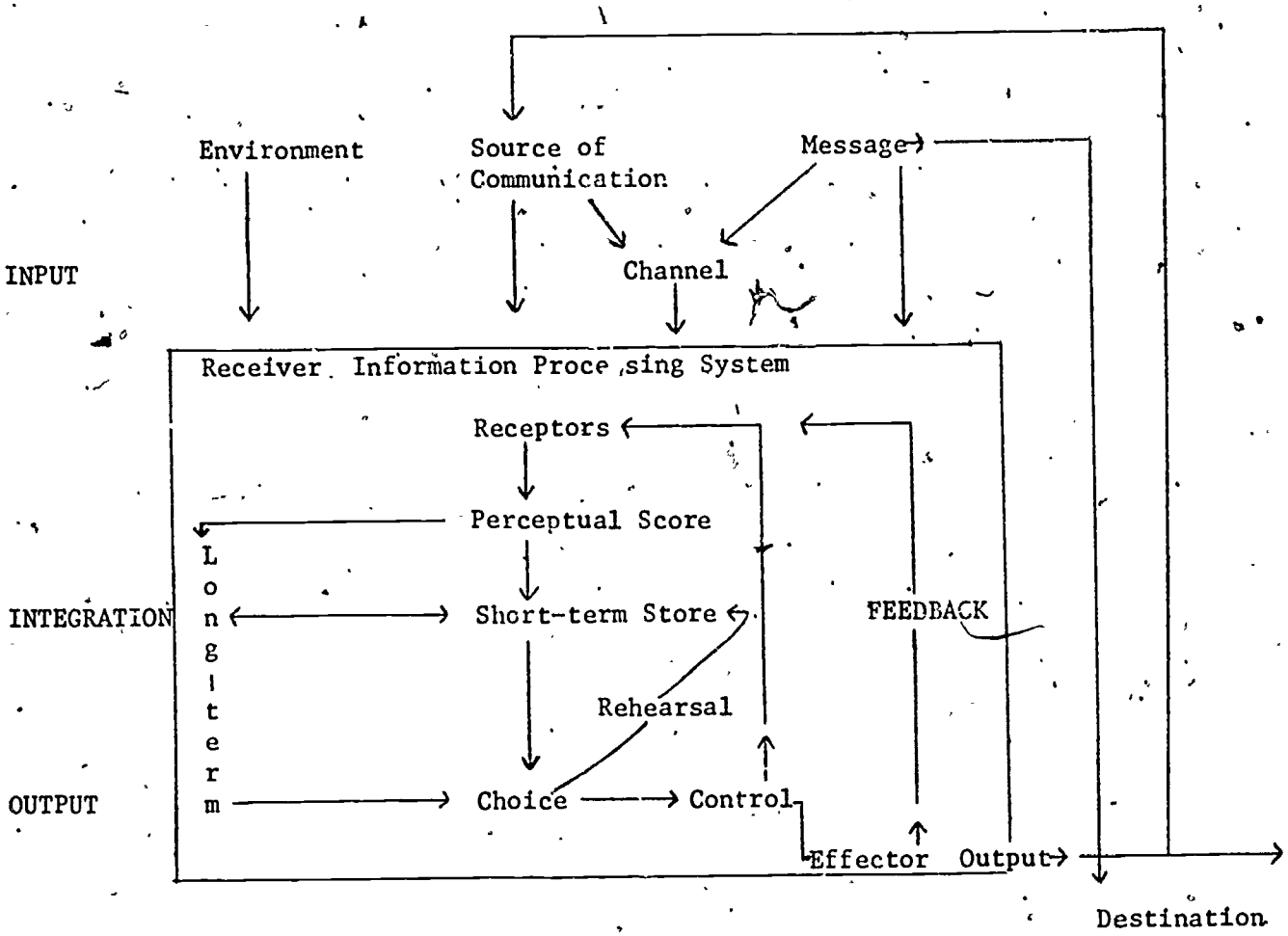
1. the nature of the learner
2. the nature and type of teacher and teaching style
3. the nature of knowledge
4. the teaching/learning milieux (Schwab and Harper, 1970).

The model, "Variables Affecting Experiential Learning," illustrates the interrelationships of the various processes and variables. The rest of the paper will be devoted to explanation, research support, and practical implications.

The basic foundation for the model is the perceptual process. The term "perception" is often used as if it were a one-stage process that occurs automatically and is identical for everyone. Actually, perception involves the four stages of input, integration, output, and feedback. The input might be the same for all, but individual differences affect the other three stages not only in effectiveness and efficiency, but also in variety of response. This process can be viewed as a servo-mechanism that contains both constant monitoring and a feedback loop system. Feedback, which is part of the output, serves as further input at the monitoring level.

Input. There are four major sources of input, the first being an environmental factor - the specific setting - and three that have to do with the social-communication process. The most important environmental variable in experiential

VARIABLES AFFECTING EXPERIENTIAL LEARNING



Perceptual Process		Parameters of Learning		Communication Variables
INPUT	=	the nature and type of teacher,	=	Source
	=	teaching style,	=	Channel
	=	nature of knowledge,	=	Message
	=	plus the teaching and learning mileux	=	Environment
INTEGRATION	=	Information Processing	=	Receiver
OUTPUT	=	Effector action	=	Destination
FEEDBACK	=	beginning again	=	INPUT

learning is novelty, for "stimuli which cause arousal will be those which are novel, very intense or signals of danger because it is to these that habituation least easily occurs" (Welford, 1968:264). Novel information receives attention and is processed even in an overload situation when there is more input than the system can process. Longitudinal studies are needed to demonstrate that the general arousal, attitude and/or knowledge gained under novel situations will be retained when the students have re-entered their original environment. Environments for experiential learning sometimes take the form of short-term but very intense programs. Since Broadbent (1957) has demonstrated that people are basically one-channel processors (being able to attend to one message at a time) when sensory input is high, experiential programs will have to be careful not to overload the system. When overload occurs, the individual decides what should be processed. In that event, educators cannot assume that the most important or desirable information is being processed. In a situation of information overload, which may occur most obviously and purposefully in a multi-projector, multi-media program, the intended informational objectives may be sidestepped completely. There are severe limitations to the rate at which material can be learned. During World War II, the U.S. Army developed "crash" learning programs to impart basic skills in as brief a time as possible. Language learning, which can involve the creation of a whole new environment, has experienced great success when taught this way. Environmental education programs, when conducted in a camp or conference setting, also adopt this intensified learning format. Depending on the objectives of the program, such an arrangement may or may not be beneficial. Experience with a four-week program at the Terra Alta Biology Station indicates that, while massive factual learning seems to take place in a short period of time, long-term retention appears to be less than in a regular one-semester course. If the objectives for the course were socialization and enjoyment in the midst of a nature appreciation and awareness experience, such a short program would far outscore the regular semester-long arrangement.

Environmental programs, whether they intend to or not, change individuals through social communication, and social communication has been shown to involve the following five independent variables:

1. source factors
2. message factors
3. channel factors
4. receiver factors
5. destination factors

The first three variables (source, message, and channel) are part of the input. Attributes of the source: credibility, attractiveness, and power add to the impact of a program. Apparently information or arguments are not evaluated if the source is viewed as an objective expert, i.e. has credibility.

> An individual's tendency to accept a communication depends, in part, upon how well-informed, intelligent, and trustworthy he believes the communicator to be (Dick, McKee, Wagar; 1974:8).

If self-esteem through identification with the source can be enhanced, then there is also greater acceptance of the resulting message from that source. Often membership ranks are determined by the image people have of a particular group. This use of group-affiliation by image alteration is effectively employed in advertising. The same factors apply in all human community establishment. Just as one is made more loveable by using new Deodorant Dial, or more energetic by showering with Zest, so one is made more humane by identifying with

Leopold Stokowski, or more ecological by identifying with Euell Gibbons.

Most environmental education programs list attitudinal change as an objective. Both attitude change and knowledge are affected by factors of the message. Persuasive appeals can be rational or emotional. Research indicates a positive relationship between intensity of fear arousal and amount of attitude change (McGuire, 1969:204). This might help explain the abundance of "doom's day" film and material. Marler concluded, after investigating the effects of various anti-litter messages on knowledge and behavior, that "the most effective approach the conservationist can take is a negative, punishment-oriented approach" (1971:52). Other factors such as clarity, humor, skill in presentation play a role. For example, the persuasive messages that have explicitly drawn a conclusion seem to be more effective than those messages that leave the conclusion up to the receiver, especially if there is little motivation and time for the recipient to arrive at conclusions. Once again we notice the time factor that may have been overlooked in environmental education research. When should conclusions be presented, first or last? First, if the serial position effect of memory is applied (recall reflects the presentation order of first, last, and then middle). Last, if any inquiry method is to be followed. This discrepancy calls for not only further research in the area of experiential learning, but more immediately, for some care and caution in the use of the experiential method. Suppose the goal is "learning the difference between Sycamore and Maple leafs". Some previous instruction is necessary--enough to be able to identify likely sources of these two similar leaves, their comparison and differentiation, and then perhaps further questions, such as: Where do the Sycamore grow? Does the type of soil affect leaf size?

How is the message to be communicated? McLuhan (1964) became famous for suggesting that the medium was more important than the content. Here again, the favorable memories that campers recall may indicate the environmental message was well received, or it may only indicate that they had a good time at camp. There is also some evidence that long-maintained contact produces favorable inclinations.

Integration. There are a host of other input considerations, but for now the previous discussion on environment, source of communication, message, and the channel will suffice. The input stage is followed by integration. Integration involves receiver factors, which are individual differences related to processing the perceived information. The important question here is the role of active participation on learning, attitude change and individual strategy of processing (individual differences in perceiving, translating, storing, retrieving and decision making). Environmental educators, among others, seem to assume that

> A given communication will be more persuasive to the extent that the receiver is called upon to participate actively by improvising its contents, rather than merely reading passively a communication prepared for him. The results, however, are quite to the contrary (McGuire, 1969:235).

Greenbaum (1963), Jansen and Stolurow (1962), McGuire (1961) and McGuire and Papageorgis (1961) found that more opinion changed with passive reading than with active improvisation. The explanation offered is as follows:

> The person is generally unprepared and unmotivated to find the appropriate information with which to improvise, and hence is more affected by the passive reading of prepackaged persuasive communications (McGuire, 1969:236).

Three methods of learning--simulation exercises, simulation games, and a control method using films--were compared for their effectiveness in fostering facts, concepts, relationships and favorable attitudes towards ecology in the 3rd, 4th and 8th grade. No significant difference was found (Fennessey et al., 1974). This might mean that experiential learning still needs to be goal directive and highly structured; that research methods for measurement need to be improved; or that age, knowledge and other variables need to be considered.

The integration stage of the perceptual process is comprised of various receivers, coders (transducers), storage systems and retrievers of the individual's information processing system. Environmental Education programs can alter one's perceptual set so that attention and consequently reception can be directed to new or different information. Practice or rehearsal of a new activity can improve the effectiveness and efficiency of the information processing system. One who never noticed or differentiated bird song can quickly pick up and develop the ability to perceive and recognize various bird calls. It is a fairly well accepted fact that the senses develop (sensory differentiated learning) in part, to the degree that the environment demands (Burrus-Bammel, 1976). Kephart (1969) phrased it in this fashion: structure determines function which in turn determines future structure. This implies that actions repeated affect the structure anatomically and/or physiologically.

New information, once received, will either exit the system (be lost) or go to one of the storage units. If the information is extremely important to the individual or closely related to other stored information, it might go directly to long-term storage. Most new information passes through short-term storage before it ends up in long-term storage. Data from signals can be stored in short-term until other mechanisms are ready to use them as a basis for action, or for several seconds. Short-term will, however, lose information rapidly in the absence of sustained attention since data in this store are extremely vulnerable to interference from other material coming after, or to any shift in the subject's attention. Short-term storage can also involve recirculation of the data which not only prolongs the period of retention by "rewriting" the traces in the short-term itself, but also tends to pass material to long-term storage--the main storage unit. Unused items will eventually be lost from long-term. There is a school of thought that maintains that nothing is ever lost from long-term, rather the difficulty is in the retrieving. This would explain the importance of key words or events that bring information to the surface that had previously been long neglected. Various mnemonic devices are often helpful in the memory process.

Some environmental programs offer a large quantity of information in a short period of time. Immediate pre and post testing can demonstrate a significant difference, but what would a half-year or year retention test indicate (Burrus-Bammel, 1977)? More environmental education research involving a control group in order to demonstrate that the E.E. program is significantly different from a period of "traditional" class room or another special program is needed, for "research appears to have been done on those things easiest to grasp rather than in terms of what is needed to be known" (Donaldson, 1972:9).

The overriding question is, What are the objectives? Is it attitudes, knowledge, awareness, appreciation, or a combination of the above?

> There is a critical need to define the objectives common to the several types of environment related educational programs and devise an overall strategy for their respective application (Hendee, 1972:19).

It could be that the E.E. programs concerned with attitudes do not begin early enough. Research has indicated that maximum suggestibility is generally found at about eight or nine years of age and after that it declines until adolescence when it levels off (Barber and Calverley, 1964; Messerschmidt, 1933; Stukat, 1958; McGuire, 1969). "The link between goals and strategies cannot be over-emphasized" (Horn, 1971:20).

Some states have developed a comprehensive E.E. progfam. Roth (1970:85) and others have pointed to the difficulty of establishing an appropriate sequence of events. It is important to have an effective, logical sequence. Ideally, attitudes could be established by an early age which would predispose children favorably to learning factual information that could support their attitudes, increase their awareness and promote greater appreciation.

Output and Feedback. Past experience which could be in the form of attitudes, knowledge, appreciation or awareness helps determine the choice of output--the third stage of the perceptual process. This output could be physical and/or mental. Part of the output, knowledge (awareness) of the action, is fed back into the system both internally and externally; thus we can sense the movement and see or feel the effects of the action. Feedback is the final stage of the perceptual process which also serves as the beginning for another sequence since new input is supplied. "Perhaps no general concept or principle is more important for interpretation than that of feedback" (Field and Wagar, 1973:16).

A part of output not only is directed back as input, but it also can serve as knowledge of results for the source. The source, teacher, needs to be aware of the reaction to the message and the channel. What is effective for one class, one age, etc. may or may not be for another. An effective communicator must constantly be aware of the receivers' responses.

Conclusion. Experiential learning would seem to foster greater control over future desired action, because the actual use of the system improves the ability of the system. Therefore, physical control and retrieval ability would be increased more than in the usual directive, command type of passive learning mode. While it appears that there are greater "fringe" benefits to the experiential type of program, can these be measured?

A major aim of any E.E. program should be to harmonize the individual's output with the desired destination of the message, whether that is attitude change, knowledge, awareness, or appreciation.

The education field is developing and the need is increasing for effective programs. We can get bogged down in the concern with the content of our programs and forget to study the medium. Due attention must be paid to studies in perception and information processing if we are to maximize our opportunities. To paraphrase McLuhan, the receiver will not get the message, if the medium fails to mediate.

REFERENCES

Barber, T.X. and Calverley, D.S. (1964). Hypnotizability, Suggestibility and Personality: IV. A Study with the Leary Interpersonal Checklist. Brit. J. soc. clin. Psychol. 3:149-150.

Broadbent, D.E. (1957) A Mechanical Model for Human Attention and Immediate Memory. Psychol. Rev. 64:205-215.

Burrus-Bammel, Lei Lane. (1977). A Longitudinal Study, Information's Effect on Attitude. NAEE Sixth Conference, April 24-26, Estes Park, Colorado.

_____ (1976). Recreationists Can Promote Cognitive Development. Canadian Recreation Review. 4(4):22-26.

Dick, Ronald E., McKee, David T. and Wagar, Alan (1974). A Summary and Annotated Bibliography of Communication Principles. J. of Environmental Education. 5(4):8-13.

Donaldson, George. (1972). Research in Outdoor Education. J. of Environmental Education. 3(4):9-10.

Fennessey, Livingston, Edwards, Kidder, and Nafziger. (1974). Simulation, Gaming, and Conventional Instruction in the Teaching of Ecology. J. of Environmental Education. 5(4):21-24.

Field, Donald R. and Wagar, Alan. (1973). Visitor Groups and Interpretation in Parks and Other Outdoor Leisure Settings. J. of Environmental Education. 5(1):12-17.

Greenbaum, C.W. (1963). The Effects of Choice and Reinforcement on Attitude Change in a Role-Playing Situation. Doctoral Dissertation, New York University.

Hendee, John C. (1972). Challenging the Folklore of Environmental Education. J. of Environmental Education. 3(3):19-23.

Horn, B. Ray. (1971). Perspectives for Developing a State Master Plan. J. of Environmental Education. 3(2):20-22.

Jansen, M.J. and Stolurow, L.M. (1962). An Experimental Study in Role Playing. Psychol. Monogr. 76(31), whole NO. 550.

Kephart, Newell C. (1969). Talk at the Special Study Institute, "Current Trends for Children," Los Angeles, California, March 13.

Marler, Lela. (1971). A Study of Anti-Litter Messages. J. of Environmental Education. 3(1):52-53.

Martin, William. (1975). Participant Observation as an Exploratory Method of Conducting Research in Outdoor and Environmental Education. In van der Smissen, Research Camping and Environmental Education, Penn State HPER Series, No. 11.

McGuire, W.J. (1961). Resistance to Persuasion Confirmed by Active and Passive Prior Refutation of the Same and Alternative Counterarguments. J. abnorm. soc. Psychol. 63:326-332.

_____ (1969). The Nature of Attitude Change. In Lindzey, Gardner and Aronson, Elliot (ed.), The Handbook of Social Psychology. 136-314.

McGuire, W.J. and Papageorgis. (1961). The Relative Efficacy of Various Types of Prior Belief-Defense in Producing Immunity against Persuasion. J. abnorm. soc. Psychol. 62:327-337.

McLuhan, M. (1964). Understanding Media. New York: McGraw-Hill.

Messersqhmidt, R. (1933). The Suggestibility of Boys and Girls Between the Ages of Six and Sixteen Years. J. genet. Psychol. 43:422-427.

Roth, Robert. (1970). Review of People and Their Environment. Brennan, Mather. J. of Environmental Education. 1(3):85.

Schwab, Joseph J. and Harper, William R. (1970). The Practical: A Language for Curriculum. Washington, D. C.: National Association Center for the Study of Instruction.

Stukat, K.G. (1958). Suggestibility: A Factorial and Experimental Study. Stockholm: Almqvist and Wiksell.

Van Matre, Steve. (1972). Acclimatization. American Camping Association, Martinsville, Indiana.

Welford, A.T. (1968). Fundamentals of Skill. Methuen & Co., Ltd., London.

INFORMATION'S EFFECT ON ATTITUDE: A LONGITUDINAL STUDY

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Introduction

Attitudes, behavior, and knowledge are often mentioned in statements of objectives of many environmental education programs. It seems that there is an assumption that attitudes affect behavior and that knowledge in turn affects attitude. Hendee has called these assumptions the folklore of environmental education and has pointed out the need for investigation and reviewing research literature (Hendee, 1972). Wicker reviewed the attitude-behavior consistency articles and concluded that

> it is considerably more likely that attitudes will be unrelated or only slightly related to overt behaviors than that attitudes will be closely related to actions (1969:65).
>
> Only rarely can as much as 10 percent of the variance in overt behavioral measures be accounted for by attitudinal data (1969:65).

The same type of correlation problem exists between knowledge and attitude. "I have severely questioned whether information has any effect upon attitudes and whether attitudes have any effect on behavior" (Abelson, 1972:23).

Not only are many programs based upon these unproven assumptions, but numerous research papers discuss these terms without definitions; this makes comparisons difficult and application of findings nearly impossible. Eleven articles have appeared in the Journal of Environmental Education on the topic of attitudes (Bart, 1972a; Bart, 1972b; Bowman, 1975; Carlson, 1974; Cohen, 1973; Hounshell and Liggett, 1973; Knapp, 1972; Pettus, 1976; Ramsey and Rickson, 1976; Stamm and Bowes, 1972; Watkins, 1975), but only Cohen and Knapp defined their term.

What is an attitude? Is it the result of a cognitive-affective-conative (knowing-feeling-acting) analysis? Allport's (1935) definition involved the following five components:

1. it is a mental and neural state
2. of readiness to respond
3. organized
4. through experience
5. exerting a directive and/or dynamic influence on behavior.

Attitude was also viewed by Allport as the second point along a single continuum of opinion, attitude, interest and value. These ideas were published just prior to the shift of concentration from attitude research (late 1930's) to group dynamics (1950). "Any topic that has received a great deal of attention for an extended period of time 'tends to lose its novelty and heuristic provocativeness'" (McGuire, 1969:137). The concern for attitudes returned by 1960 and since that time techniques, methodologies and theories have become more sophisticated. Allport's previous cognitive-affective-conative aspects of attitudes have been recently relegated by Rokeach to the cognitive, affective, behavioral components of beliefs. An attitude was now considered as "a relatively enduring organization of beliefs about an object or situation predisposing one to respond in some preferential manner" (1975:134). The attitude-behavior relationship is further supported by studies of Fishbein and Ajzen. They present an impressive argument that attitudes, "a predisposition to respond in a consistent manner," are related to overt behavior and can be predictive of multiple-act behavior the pattern of behavior (Fishbein and Ajzen, 1974:59,61). Attitudes, however, are most commonly defined as the favorable or unfavorable response toward a statement, event, or class of objects.

West Virginia Forest Industries Camp

The purpose of this study was to investigate the immediate, intermediate, and long term effect that a week long environmental education youth camp, independent variable, would have on the dependent variables of knowledge and attitude. In the present study attitude and knowledge were defined as:

> Attitude. The subject's total score for favorable or unfavorable responses to 16 Likert type statements on a variety of environmental topics.
>
> Knowledge. The student's total score on 15 true-false items which are formulated to ascertain the participant's environmental conceptual and/or factual information base.

In 1975 Bennett pointed out that very little hard data had been gathered to determine the resulting effects of various environmental education programs. Not one of the 117 abstracted studies in Research in Outdoor Education correlated knowledge and attitude nor reported attitude or knowledge change over various time periods. In her opening remarks on "The Dynamics of Research" for the National Research Workshop, van der Smissen commented that

> there need to be more studies concerning retention; how long does a 'peak experience' have impact? There seems to be a great need for reinforcement after leaving the resident program (1975:14).

Hypotheses for the study were:

1. The West Virginia Forest Industries Camp would produce a significant change (.05) from pre-test to post-test on both the knowledge and attitude test.

2. The experimental groups would differ significantly between the pre-test and retention test.

3. The control group would vary significantly from the experimental on the retention test.

The West Virginia Forest Industries Camp's staff teaches environmental education in a camping atmosphere with specific emphasis placed on forests and forest industry. Selected campers are predominantly rural males 16 to 20 years of age, each of them having been recommended by a forester, teacher, or other youth leader. Final selection was based upon written recommendations and statements of interest by the individual applicant. The camp is sponsored by West Virginia University and the Forest Industries of West Virginia. Each contributes resources to the production and delivery of a week of intensive instruction with the expectation that certain goals will be met. The goal was to develop a fundamental philosophical attitude that views the environment in which people live as a total system that has as its major component a natural system upon which are imposed the social, political and economic systems. Therefore, the teaching program focused upon developing a specific understanding of the Eastern Hardwood Forest ecosystem and the knowledge that it can be used to produce the goods and services required by people without destroying or degrading its contribution to the environment. All classroom instructional materials were developed and tested prior to the camp, as were the field exercises. On the day before camp began, the instructional staff met and conducted a full dress rehearsal.

Camp Procedure

During the week at Camp Pocahontas, the participants were isolated from the usual types of media such as television, radio, and newspapers. The campers did receive illustrated evening lectures, took part in on-site role playing where groups assumed defensible single-use* advocacy positions, and sought to harmonize differences with other single-use groups. Field trips provided knowledge of the forest ecosystem and included tours of wood products plants which demonstrated the progress from log to finished wood product, and on-site practical demonstrations with camper participation (experience installing transects and recording data that provided a picture of the forest, plants, animals, and historical use). By the close of the session, the individuals had received information of the tangible benefits of wood, water, recreation, as well as the intangible aesthetic influences. The one-week camp dealt with knowledge of the processes that maintain the ecosystem, awareness of injurious agents, of multiple use, and with social action processes. The campers became aware of the complexities of forest land management, and of the opportunities and responsibilities associated with forest ownership.

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*As opposed to multiple-use, that is, the production of two or more products from the same area.

Evaluation

A written objective test was given at the beginning of the week to determine attitudes, conceptual knowledge, and factual knowledge. This same instrument was administered at the close of camp in order to establish whether or not any change in attitudes or knowledge had occurred, and if change had occurred, the direction and degree of that change. The information so obtained would serve as feedback for the individual instructors and the camp education director to use for identifying subject areas that might need modification for future programs as well as determining the effects of the program over time.

Attitudes were measured by application of a Likert type scale which is "easy to construct and administer" as well as being "valid and reliable in measuring attitudes toward a variety of environmental topics" (Millward, 1975:50). Each participant responded to 16 statements (Appendix A) such as, "A forest that is managed for timber production has little use for other purposes such as recreation, wildlife, and pure water". Responses were made by circling either SA (strongly agree), A (agree), D (disagree), SD (strongly disagree), or DK (don't know). A reliability coefficient of .84 was determined by analyzing the 1976 control group test-retest scores (Table 1). Responses from a panel of three experts were averaged to establish an overall validity coefficient of .92.

The next 15 items on the test were of true-false nature and were formulated to ascertain the participant's conceptual or factual knowledge base (Appendix B). A reliability coefficient of .90 was determined by analyzing the 1976 control group test-retest scores (Table I).

TABLE I

LINEAR REGRESSION TEST-RETEST KNOWLEDGE AND RELIABILITY COEFFICIENT

Knowledge	$\bar{x}$	SD	F Ratio	df	"r"
Summer 1976 (N=29) Control	19.40	5.841	56.366	13	.901**
Six month retention (n=29)	20.267	6.734			
Attitude					
Summer 1976 Control	3.937	.436	32.978	14	.838*
	3.831	.434			

** .90- .99 High correlation
* .80- .89 Good (Meyers and Blesh, 1962:63)

Twenty-nine (29) young men, in 1975, participated in what would be called a one-group pre-test, post-test design, actually a pre-experimental design that according to Campbell and Stanley (1963) is widely used in educational research. The camp had been using this internal evaluation procedure, a one-group pre-test, post-test design, for several years. A problem with the design, however,

is that the internal validity is weak, and other factors (extraneous variables) could offer plausible alternative hypotheses to the actual camp experience ("X") for explaining the difference between the pre- and post-test. Therefore, in 1975, another group of males (N=23) in the same age range who had also applied to the summer camp program but couldn't be accommodated, were also given the test shortly after the summer program was completed. This procedure added the near equivalence of a post-test only control group. Hence the previously uncontrolled factors of history, maturation, and instrumentation were partially factored out.

The procedure could be diagrammed in the following manner, with "O" representing some type of observation of the dependent variable, in this situation the tests; "X" indicating the independent variable, the summer camp program. Symbols on a horizontal line refer to the same group, while verticals refer to the same point in time.

1975	Pre-test	Camp	Post-test
Experimental (Camp) Group (N=29)	O	X	O
Control (Non-camp) Group (N=23)			O

Addition of the "post-test only control group" helped to eliminate the plausible explanation that the difference between the experimental group's pre- and post-test was due to some factor other than the camp experience. The fact that both groups were receiving some new information daily is kept in balance by the testing of the control group. The "one group pre-test, post-test" could indicate that the camp had caused a significant change in the camper's attitudes and knowledge during the week, but one would not know if it was significantly greater than the experiences of the non-camp youth. The question is not as simple as "X" versus no "X", but rather "X" versus normal situations. Possibly the newspapers could have run an article on ecosystems and the forest, or educational television might have shown a film on forest management. The root question being tested is: "Is the effect of the camp experience significantly different from that of a normal summer week in changing attitudes and knowledge?"

Results from the 1975 data indicated that there was for the campers (experimental group) a significant attitude and knowledge change during the week at camp and that the post-test of the campers varied significantly from that of the control group (Tables II and III, Figures 1 & 2). The data could not predict what would happen once the campers returned to their previous environment, previous behavior patterns and previous peer groups. Would the significant knowledge and attitude change endure over time? Therefore, the same general procedure was repeated in 1976 with an additional 6 month retention test. The identical test was also mailed to the 1975 groups in order to provide a year and a half retention measure. This procedure could be diagrammed in the following manner.

	Pre-test	Camp	Post-test	Retention: 6 mos.	1 1/2 year
1975 Exp. G. (N=32)	O	X	O (N=29)		O (N=12)
1975 Control (N=23)			O		O
1976 Exp. G. (N=36)	O	X	O	O (N=30)	
1976 Control (N=29)			O	O (N=29)	

Why weren't the control groups pre- and post-tested? Due to the mailing response rate, the two tests could not be equally separated by a week. A future possibi-

lity is to test a local group for the control group instead of a mailing to various parts of the state. The response rate was too low for the 1975 control group for statistical analysis. All subjects for the 1975 experimental and control groups were young males 16 to 20 years of age. In 1976, however, approximately 20 percent of the experimental and 30 percent of the control group participants were young females. Eleven (11) females and 32 males were on the approved list for each group, 7 actually participated in the camp and 9 in the control situation. The response rate for the 1975 experimental group year and a half retention test was 37.5 percent, 69.76 for the 1976 experimental retention test and 67.44 for the 1976 control 6 month retention test.

Results and Discussion

Within and between group differences were analyzed by a paired "t" test; percentages on the knowledge test were transfo[illegible]rcsin valves. Both the 1975 and 1976 Experimental (Camper) groups [illegible]ved significantly (.01) between pre- and post-test on attitude and knowledge (Table II). The control was always significantly lower than the experimental group on post-test comparisons (Table III, Figures 1 4). Both the 1975 and 1976 experimental groups maintained the increased attitude and knowledge for there was no significant difference (.01 or .05) between post-test and retention measures (Table II). This is supported by the fact that in each situation the retention test was significantly higher (.01) than the pre-test (Table II). Subjects in the control group did not significantly (.01 or .05) vary between the summer test (post-test equivalent) and the retention test (Table II). The percent of learned knowledge retained was 78.71 and 68.56 percent of attitude. Between-group data indicated that the 1976 experimental attitude retention scores were significantly higher (.01) than the control group, while the knowledge scores only approached the .1 level. Therefore, the three previously stated hypotheses for the study were accepted and the null hypotheses of no significant difference rejected.

The relationship between knowledge and attitude was anlayzed, once with a linear regression with ANOV and once with a Wiant test (similar to McNemar). No significant (.01 or .05) relationship was indicated between knowledge and attitude when the 1976 control group's summer scores, the 1976 experimental group's pre-test and the post-test (.1) was analyzed (Table IV). Significance was never approached on the Wiant test.

There were certain limitations due to the non-random nature of the control group, low response rate for the 1975 groups, utilization of the post-test only design, the tests were not standardized, and the paper-pencil type tests only serve as one form of check. Recommendation for further study would be to more completely control the internal validity factors of history and maturation by adopting the true experimental design of Pre-test, Post-test Control Group; to determine the spillover or communicative values within society resulting from any given environmental program.

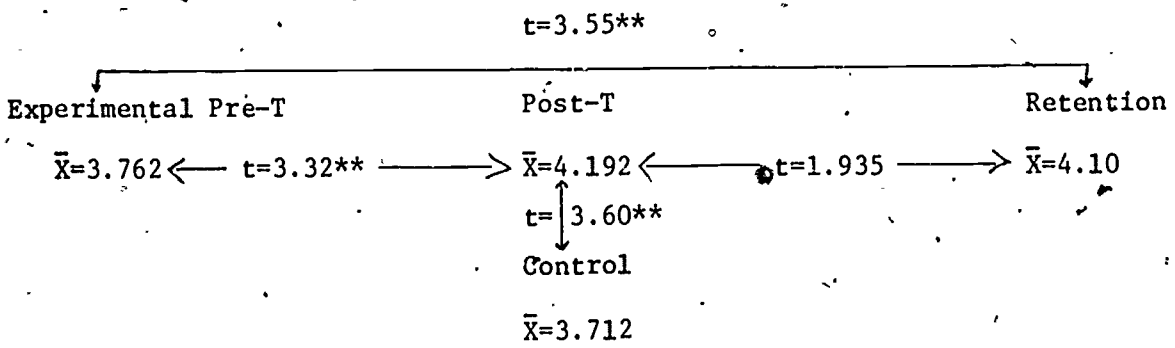

Figure 1. 1975 Between and within group attitude scores.

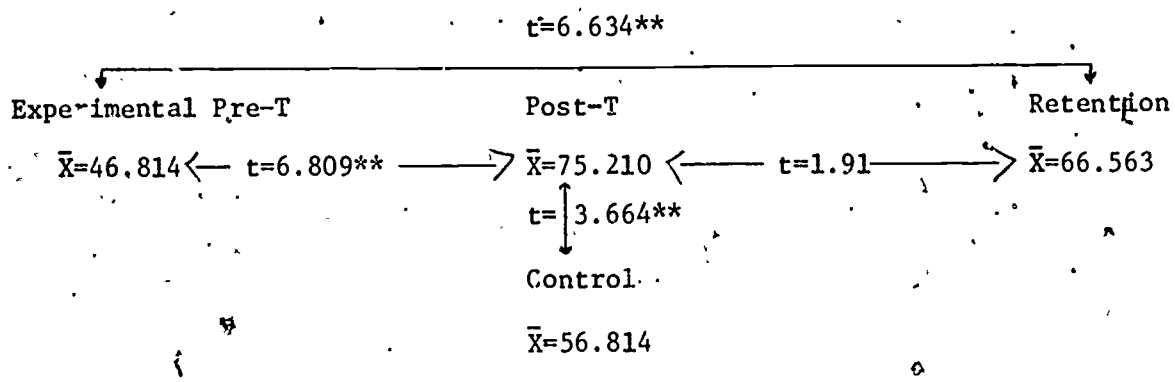

Figure 2. 1975 Between and within group knowledge scores.

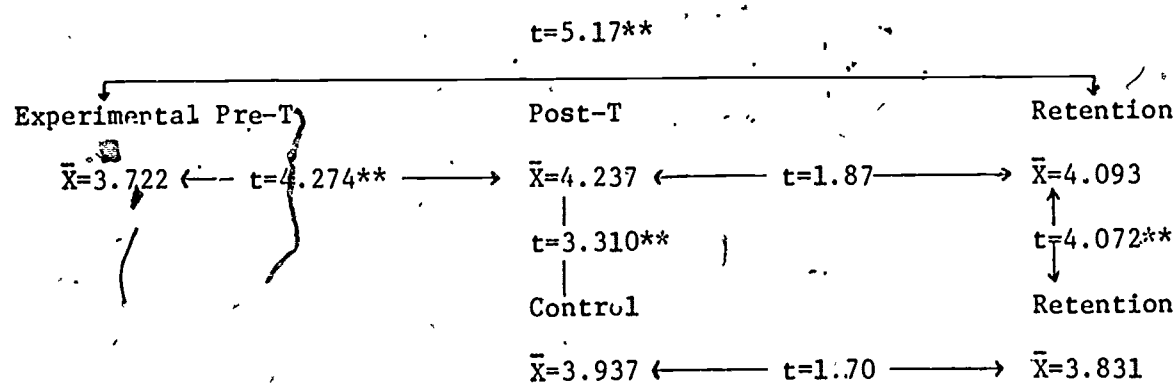

Figure 3. 1976 Between and within group attitude scores.

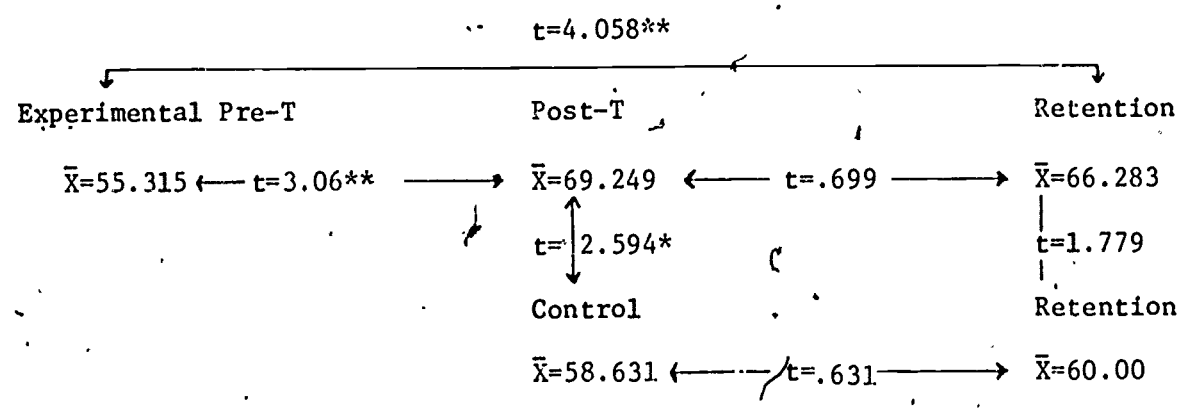

Figure 4. 1976 Between and within group knowledge scores.

TABLE II

WITHIN GROUP PAIRED "t" TEST

	$\bar{x}$	SD	$\bar{x}$	SD	Mean D	"t"	df	sig.
	Pre-test		Post-test					
1975 Exp. G. "A" (N=29)	3.762	.594	4.193	.648	.431	3.32	15	*
Knowledge	46.814	17.361	75.21	13.152	28.396	6.809	14	**
1976 Exp. G. "A" (N=36)	3.722	.502	4.237	.346	.515	4.274	15	**
Knowledge	55.315	19.717	69.249	10.689	13.934	3.06	14	**
	Post-test		Retention					
1975 Exp. G. "A"	4.193	.648	4.104	.564	.090	.935	15	
Knowledge	75.21	13.152	66.565	16.014	8.645	1.913	14	
1976 Exp. G. "A"	4.237	.346	4.093	.432	.144	1.876	15	
Knowledge	69.249	10.689	66.283	20.734	2.966	.699	14	
1976 Control "A"	3.937	.436	3.831	.434	.106	1.705	15	
Knowledge	58.631	16.314	60.000	15.660	1.369	.612	14	
	Pre-test		Retention					
1975 Exp. G. "A"	3.76	.594	4.104	.564	.342	3.557	15	**
Knowledge	46.814	15.277	66.565	16.014	19.751	6.635	14	**
1976 Exp. G. "A"	3.722	.502	4.093	.432	.371	5.172	15	**
Knowledge	55.315	19.717	66.283	20.734	10.968	4.059	14	**

"A" - Attitude

** Significant at .01 level, 15 df 2.947, 14 df 2.977

* Significant at .05 level, 15 df 2.131, 14 df 2.145

Table III

BETWEEN GROUP PAIRED "t" TEST

	$\bar{x}$	SD	$\bar{x}$	SD	Mean D	"t"	df	sig.
	Exp. Pre-test		Control test					
1975 Attitude	3.762	.594	3.712	.543	.353	.567	15	
1975 Knowledge	46.814	17.362	56.814	17.663	13.333	2.905	14	*
1976 Attitude	3.722	.502	3.937	.436	.390	2.20	15	*
1976 Knowledge	55.315	19.717	58.631	16.314	12.932	.993	14	
	Exp. Post-test		Control test					
1975 Attitude	4.193	.648	3.712	.543	.534	3.60	15	**
1975 Knowledge	75.210	13.152	56.814	17.663	19.443	3.664	14	**
1976 Attitude	4.237	.346	3.937	.436	.300	3.310	15	**
1976 Knowledge	69.249	10.689	58.631	16.318	10.618	2.594	14	*
	Exp. Retention		Control Retention					
1976 Attitude	4.093	.432	3.831	.434	.262	4.072	15	**
1976 Knowledge	66.283	20.734	60.000	15.660	13.676	1.779	14	(near .1)

"A" = Attitude

** Significant at .01 level, 15 df 2.947, 14 df 2.977

* Significant at .05 level, 15 df 2.131, 14 df 2.145

TABLE IV.

LINEAR REGRESSION WITH ANOV CORRELATION BETWEEN ATTITUDE AND KNOWLEDGE

	Attitude		Knowledge					
	$\bar{x}$	SD	$\bar{x}$	SD	F ratio	R	df	sig.
1976 Exp. Group pre-test	59.778	5.270	9.167	2.408	.752	.147	34	
1976 Exp. G. Post Post	67.528	7.137	12.778	1.869	3.643	.311	34	(.1)
1976 Control G Summer	62.621	5.388	10.483	2.530	.948	.184	27	

APPENDIX A

Attitude

1. A forest that is managed for timber production has little use for other purposes such as recreation, wildlife, pure water.

2. It is not possible for a forest to produce timber, water, recreation and wildlife.

3. The largest portion of forest land in W.V. should be placed in preserves to provide enjoyment for future generations.

4. The most important use of W.V.'s forest land is to produce game and fish for sportsmen.

5. Forests are for people and should be managed to provide all goods and services, timber, water, recreation, etc.

6. Clearcutting is a poor forest practice when viewed in a total forest management sense.

7. The most important use of W.V.'s forest land is to provide a place of beauty for people.

8. Society should not concern itself about how forest lands are allocated for use. Decisions should be left to the professional forester.

9. Selection cutting is a poor forest practice when viewed in a total forest management sense.

10. The most important use of W.V.'s forest land is to produce timber products for people.

11. Rational forest policy will recognize the costs as well as the benefits.

12. The most important use of W.V.'s forest is to provide a place of recreation for people.

13. Timber harvesting should not be allowed in West Virginia.

14. The wood industry of West Virginia manages its timber land to produce timber in such a way as to not destroy the other values.

15. Timber harvesting should be allowed on forested lands that are managed for that purpose.

16. The most important use of West Virginia's forest land is to provide all goods and services normally available from forest land.

APPENDIX B

Conceptual and Factual Knowledge

1. A windstorm blows down trees on several acres of forest land. No changes will occur in the forest since trees were the only part destroyed.

2. Water, sunlight and soil are all necessary ingredients to the growth and development of forest plants but play only a minor role in producing adequate numbers of hawks, bobcats and other such animals.

3. Soil is a non-living part of the forest ecosystem.

4. One effect of cutting trees on the stream ecosystem is to increase the quality of soil material that it carries.

5. Insects and other micro-organisms that occur in the forest ecosystem are a menace to its existence.

6. Natural systems are separate and apart from social, political and economic systems. That is, there is no relationship of one to the other.

7. West Virginia's forest industry plays a major role in making forest management possible in many privately owned woodlots.

8. Soils, elevation, moisture, temperature and compass direction have little effect on the kinds of trees, plants and animals that occur on that site.

9. Inventorying the forest includes recording of: tree and other plant species, quality of site relative to tree growth, topographic features and man-made structures, etc.

10. Properly located and constructed logging roads will reduce the quantity of soil material in forest streams.

11. The most desirable habitat for the white tailed deer and ruffed grouse is created by heavy selection harvest cuts or clearcuts.

12. Knowledge about the forest resource and its relationship to the other aspects of our life is necessary before good forest policy can be developed.

13. In West Virginia it is usually necessary to replant with seedlings after timber has been harves

14. Forest fires that burn along the surface of the forest floor do not damage the larger trees.

15. An increment borer is a forest insect pest that occurs in West Virginia.

REFERENCES

Ajzen, Icek and Fishbein, Martin. "Attitudinal and Normative Variables as Predictors of Specific Behaviors," J. of Personality and Social Psy. 27 (1): 41-57, 1973.

Bart, William. "A Hierarchy Among Attitudes Towards Animals," J. of Environmental Education. 3 (4): 4-6, 1972a.

_____. "A Hierarchy Among Attitudes Towards the Environment," J. of Environmental Education. 4 (1): 10-14, 1972b.

Bennett, Dean. "Camping and Environmental Education Research and Evaluation Related to Environmental Actions and Behavior," in Research Camping and Environmental Education, van der Smissen, Betty. Penn State HPER Series, No. 11, 1973.

Bowman, Mary Lynne Cox. "Assessing College Student Attitudes Towards Environmental Issues," J. of Environmental Education. 6 (2): 1-5, 1975.

Campbell, Donald T. and Stanley, Julian C. Experimental and Quasi-Experimental Designs for Research. Chicago: Rand McNally & Company, 1963.

Carlson, John E. and Baumgartner, David. "The Effects of Natural Resources Camps on Youths," J. of Environmental Education. 5 (3): 1-7, 1974.

Cohen, Michael. "Environmental Information Versus Environmental Attitudes," J. of Environmental Education. 5 (2): 5-8, 1973

Fishbein, Martin and Ajzen, Icek. "Attitudes Towards Objects as Predictors of Single and Multiple Behavioral Criteria," Psychological Review, 81 (1): 59-74, 1974.

Hendee, John C. "Challenging the Folklore of Environmental Education," J. of Environmental Education. 3 (3): 1972.

Hounshell, Paul B. and Liggett, Larry. "Assessing the Effectiveness of Environmental Education," J. of Environmental Education. 5 (2): 28-30, 1973.

Knapp, Clifford E. "Attitudes and Values in Environmental Education," J. of Environmental Education. 3 (4): 26-29, 1972.

McGuire, William J. "The Nature of Attitudes and Attitude Change," in Lindzey, G. and Aronson, Elliot (ed.) The Handbook of Social Psychology. Vol. III. Addison-Wesley, Massachusetts, 1969.

Meyers, Carlton R. and Blesh, T. Erwin. Measurement in Physical Education. The Ronald Press Company, New York, 1962.

Millward, Robert E. "An Appraisal of Present Attitudinal Environmental Programs and a Prediction of Future Evaluative Trends," in Research Camping and Environmental Education, van der Smissen, Betty. Penn State HPER Series, No. 11, 1975.

Pettus, Alvin. "Environmental Education and Environmental Attitudes," J. of Environmental Education. 8 (1): 48-51, 1976.

Rokeach, Milton. Beliefs, Attitudes and Values. Jossey-Bass Publishers, San Francisco, 1975.

Stamm, Keith and Bowes, John E. "Environmental Attitudes and Reactions," J. of Environmental Education. 3 (3): 56-60, 1972.

van der Smissen, Betty. Research Camping and Environmental Education. Penn State HPER Series No. 11, 1975.

Watkins, George A. "Scaling of Attitudes toward Population Problems," J. of Environmental Education. 7 (1): 14-20, 1975.

Wicker, Allan W. "Attitudes versus Actions: The Relationship of Verbal and Overt Behavioral Responses to Attitude Objects," J. of Social Issues. 25 (4): 41-78, 1969.

EMPHASIS - CURRICULUM AND PROGRAM

MUSES, MONITORS AND MILLENNIA: A CELEBRATION OF CHILD/ENVIRONMENT RELATIONS AND TRANSITIONAL ENVIRONMENTAL EDUCATION CURRICULA

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A discussion of the interrelationship of people-environment relations and environmental education curricula calls for a synopsis of the entangled web of dogmas, values and ethics. Peering at a new millennium, the crucial challenge of society in the next quarter century reflects the focal issue of maintaining an equitable and dynamic equilibrium between the earth's population and its resources. In essence, the major dilemmas of the world society and its finite resources necessitate a "futures" agenda in the U.S. wherein education is one of the key change agents.

In this age of unprecedented historical dislocation and discontinuity, educational change is a natural accompaniment of social revolution. Amidst this constant state of global transition, educational agencies cannot rely on mere response to change but must actively participate in the process of change. This onus on the schools is meritoriously justified. Despite their weaknesses and errors mixed with earnest intents and dedicatory service, schools "remain one of America's most important inventions for protecting and promoting an open society and for preparing young people to survive in an uncertain future" (Shane, 1976). Beyond this, the schools are truly a micro ecosystematic illustration of applied democracy in which as Ralph Tyler has expressed it, "people care, or are learning to care about others."

We are undergoing malaise and are threatened with ever more depression in many forms in our nation and Robert Heilbroner has suggested, via Campbell. (1975), "We affluent Americans will have to give up a great deal. Our privileges are more expensive than we imagine."

Traditionally education has reflected social change. Education must, howev r, accept the challenge of planning for and facilitating these changes. Amara (1976) cites three principal fronts on which critical changes must be made in order to uphold environmental capacity to sustain life and its quality in the face of systemic breakdowns. These fronts include: cognitive - improving our basic understanding of the social/political/physical environments; participative - broadening the base for making societal choices; and perceptual - developing new perceptions that govern relationships with the environment, with each other and with ourselves.

The perceptual front -- views of lifekind as a particularly vital transformation for education -- requiring basic perceptual, attitudinal and value change from human dominance of earth to a more holistic ethic, is clearly an environmental education responsibility.

It has been plain to environmental educators that infusing schools and communities with a new philosophy of human existence and long term survival has not

been simple by a long shot. Writers such as Willis Harman and Victor Ferkiss have identified the attributes of such a philosophy. Harman (1976) has submitted several features: "ecological ethics, self-realization ethic, holistic sense and open endedness." Similarly, Ferkiss (1969) argues for (1) a new naturalism - man is a part of nature rather than apart from it; (2) a new holism - a process linking men with each other and their physical-social environments; and (3) a new immanentism - the whole is viewed as shaping itself from internal rather than from external forces. Education must, of course, deal with a curriculum of affect along with cognitive change - a transformation demanding an internalization of ideas until they become the essence of man's instinctual view of lifekind.

Illusions

Schools in general continue to be symbiotic mates of a pre-ecological society. They must disengage themselves from this super-materialistic societal thrust and its concomitant illusions. The characteristic illusions of world macro problems vis-a-vis imprudent, mindless exploitation of our earth are expressed in attitudes and settled patterns of behavior. A few of these illusions are: (1) a view that our societal role "to acquire, to own, and to make a profit are the sacred and inalienable rights of the individual in the industrial society" - what Eric Fromm (1976) refers to as the "having mode," equated with the notion of "progress" in a mass consumptive society; (2) an appropriate level of consumerism in correlation with one's status/level of work; (3) growth mania tied to the GNP and employment; (4) a convenience "throw-away" ethic; (5) a passionate religious faith in technofanaticism.

Numerous other illusions prevail but the point is that traditional American formal processes of education and most of the informal ones perpetuate these illusions. It follows the Durkheimian notion of education which regards education as an enculturative agent. The function of the schools is then to enculturate/inculcate dominant values, teaching and emphasizing these carefully accepted beliefs, attitudes and knowledge. Schools have assumed this ethical duty, uncritically mirroring technicist values vital to technofanaticism and planetary rape as a means of maintaining cultural stability. Instead of serving our essential ecological needs, "we support the inertia and the dynamics of the old order by continuing to stress management and engineering techniques" (Boyer, 1974) -- a super-industrial world view (Bundy, 1976).

Moving beyond the industrial mode is the post-industrial or ecological society of the future (Boyer, 1974). And are our schools' environmental education curricula reflecting the limits of growth? There must be a turn to value self/group reliance and Schumacherism - appropriate small scale, low energy technology and craft-based, labor intensive activity. And what of programming participatory decisional politics as experiential learning as environmental education imperatives? As Ivan Illich (1973) emphasizes, the rationale for politics is to establish the design criteria for social/technical tools and to ensure these tools remain within the safe range of human use without monopoly by technicians. The post-industrial future is an open one; it would restore many basic human rights and nurture the recovery of moral/spiritual life.

The chasm between these two futures orientations is wide. Their premises about human nature, literacy, relationship to the environment and human community are different. For educators, the most important issue is that we cannot

develop the same kind of person for both of these futures. "A different kind of educated person is needed for each" (Bundy, 1976).

Given the present necessity for a rapid fundamental change, Theobald (1972) says, "It is clear then one of the main tasks of education is to discover new personal and societal interconnections. We must learn to think in new ways which are relevant in the present and will be critical to understanding the future." Shane (1976) advocates "human needs curricula" and uniting with other educational media toward achieving "humankind's ancient dreams of peace, justice and self-realization."

Toward an Environmental Education Perspective

In any situation certain pressing (and accountability) interests exist; any solution to the problems presented by incompatibility of interest can be a real solution only if all these interests are taken into account. Contrastingly, certain pressed (those represented in an essentially corporate pecuniary society) interests represent a diminution of problem solution potential.

Growing out of this pressed category is the retrogressive emphasis in formal education on the traditional basic skills complete with all the engineering trappings of the old paradigm-behavioral objectives, criterion reference tests. Teachers and principals are hemmed in by inflexible timetables, gradedness, pre-programming, hourly/daily, and monitoring systems. The propulsive return to the 3 R's is, of course, a pressed interest and U. S. schools have never lost their preoccupation with basic skills development. Their virtues have been daily recognized.

I believe the schools can be the place to respond to the compatible blend of the pressed interests of basic skills and accountability and the pressing interests of environmental education. Our younger generation has not been irretrievably locked into a materialistic consumptive ethic and the narrow, funneled pre-ecological imperatives of success. The schools still offer an engaging place for nutritive celebratory change -- to explore, to forage and to cultivate self-expression.

Environmental education is the legible, responsive and transdisciplinary curriculascape to turn to. This is not a reference to an orientation of curriculum as technology, centered on the how rather than the what of environmental education. Curriculum as technology is one of five "conflicting conceptions of curriculum" with varying assumptions as examined by Eisner and Vallance (1974).

My contention is that an environmental education curriculum should be transitional in character -- to preserve the flow and change of linkages. An experience with Project WEY (Washington Environmental Yard) in Berkeley, California - as a process/value change vehicle for environmental curriculum and environmental design entailing the deliberate change of the asphalted material environment - supports the contention. Of the five curriculum conceptions, Project WEY's phenomenological perspective reflects a leaning toward a combination of two orientations - the self-actualization or consummatory experience and the social reconstruction-relevance models.

A value saturated curriculum approach which has a passionate orientation of dynamic personal purpose and personal integration characterizes the consummatory experience curriculum; it articulates the function of providing satisfying

experiences for each individual learner. "It is child-oriented, autonomy and growth-oriented and education is seen as an enabling process that would provide the means to personal liberation and development."

Phenix (1974) represents this integrative view clearly: "A curriculum of transcendence provides the context of engendering, gestating, expecting, and celebrating the moments of singular awareness and inner illumination when each person comes into the consciousness of his inimitable personal being. It is not characterized so much by the objective content of study as by the atmosphere created by those who comprise the learning community. Its opposite is the engineering outlook that regards the learner as material to be formed by means of a variety of technical procedures."

The social reconstruction-relevance orientation embraces both a present and future orientation and both an adaptist and reformist interpretation of social relevance. Its survival-oriented bias is thoroughly compatible with environmental education.

The synthesis of these two curriculum orientations contributes to a real-life transitional environmental education curriculum. The aim is to provide a flexible organic medium to express an equilibrium of the left and right cerebral hemispheres -- merging of the duality of the rational and metaphoric mindscapes. One side celebrates affirmation; the other celebrates invention. Equilibrium nurtures the qualities of growth and strength (Samples, 1976).

The balance of the two realms nurtures the four basic metaphoric modes of thinking which Samples presents as a more holistic base for curriculum and instruction. "These modes are not epistemological, hierarchical or developmental. They are simultaneous." Just one part of one mode -- the symbolic abstract -- is commonly used to express learning in schools. The four modes are: the symbolic metaphoric mode, the synergic comparative mode, the integrative mode, and the inventive mode.

Project WEY in its six years of historicity represents a unified manifestation of an intercommunal, inter-age, transdisciplinary, humanistic model. Its spectrum of physical, social, psychological and instructional environments reflects the learning circuitry and ethic of the above curricular orientations. The enhancement of quality of the four aforementioned environments underpinning the goal for change is linked together; they make up the silent epistemological strands for the webbing nature and process of qualitative change. This process occurs with at least two concomitant thrusts: one, an autonomous unconscious internalization of a "dialogic" interaction with the physical environment by the user community; second, a more intentionally structured curriculum configuration which strings teaching personnel and students to participate towards a conscious (Wong, 1975) conceptual understanding of our ecosystems.

Both of these learning circuits are synthesized into value-charged strategies and metaphoric modes in an outdoor/indoor/outdoor cycle using WEY as a stage for curriculum shifts and transitions via landscape and biotic changes (Wong, 1977).

As a public school with a broad stri in early childhood education the contemporary educational setting places the school in the frustrations and realities of restrictive educational assessment. To communicate a differentiation of these

realities and the more balanced viewpoint discussed, the metaphoric "curricular monitors" and the "curricular muses" are introduced here.

The Curricular Monitors

This entity represents the rational, verbal, linear, sequential, standardized, mechanistic patterns of learning. The curricular monitor plays the game of predictable performance and measurable results. S/he is wrapped up with equating effectiveness with accountability. Prevailing Western culture prejudices our society towards a linear, logical sequence. In the curriculum, our language patterns and operations mirror the dominant time-ordered ethic.

The curriculum monitors regard learning as work, that work is what children do in class to learn except during recesses and when they finally leave school after the dismissal bell. Work is then as Bruner (1962) described it, "right-handed knowing." Work is also "compensatory education" to fill up/make up the "achievement gap."

David Hawkins (1974) observed with concern, "It seems we may pile up mountains of abstractions and try to pass them on while forgetting the primary motivating qualities of our learning -- of perception, engagement and enjoyment." He expressed this in relation to his fears that environmental education may become another designed didactic package and not alter "the ecological imbalance" of present education.

The Curricular Muses

These people celebrate a spatial, cyclical, holistic, intuitive metaphoric pattern of learning. There is open acceptance and fulfillment in exploring unmapped roads and s/he rejoices in transdisciplinarity and fresh new settings/challenges. Fantasy and dreams also feed into this perspective.

Children are not glutted with acculturated pre-programs, well-worn "retreads" or a bag of old tricks. Shorn of these replays and dull repertory, children will be liberated to "invent solutions rather than rehearsing old ones" (Samples, 1976).

Instead of work, the curricular muses view learning as play. Play behavior that occurs in early childhood or occurs when an event is novel is characterized by exploratory drive of curiosity (Reilly, 1974).

Summarily, the total mindscape should embrace the curricular blend of self-realization and social reconstruction-relevance orientations plus the cultivation of the monitors and the muses.

Curricular Starters and Inputs

From the efforts of Project WEY which forms the nexus of an elementary school/neighborhood/community context, a sampling of our earlier or transitional environmental education is offered here.

The curriculascape of the schoolyard offers two basic modes of collaboration for people to use as a balance between structuredness and openness and between this middle ground is eclectic and combines the two extremes; therefore, curricular activities can be a union of consciously planned and unplanned as well as an integration of people-programmed and natural unintentional aspects.

Taking the latter division, there exists a range of predictability from highly stable seasonal manifestations to completely fortuitous manifestations, to completely fortuitous phenomena such as lightning, floods, or an invasion of beetles.

The table below gives systematic expression to the range of "closed" to "open" modes that can be applied in the generation of curriculum or design activity, i.e., different kinds of "fishing poles." A short discussion of the more important might prove useful.

Several excellent packaged science curricula exist such as SCIS (Science Curriculum Improvement Study) and ESS (Elementary Science Study). Almost without exception, however, they are expectedly science-oriented and therefore lack the holistic, interdisciplinary direction which we firmly believe to be fundamental to environmental education and to life. They have a Piagetian orientation and therefore tend to start with activities and lead to concepts.

Established time-ordered curricula also tend to be too specific in the options they offer. Because of this, they normally do not provide sufficient opportunities for open-ended exploration of fresh ideas as they arise in working/playing with specific children in specific environments. They often follow a linear, logical progression, providing "only one way to go." In other words, they can be too "blue" (see Figure 1 on learning modes/curriculum connectors).

A major disadvantage of most established and engineered curricula is that they are not designed for direct utilization of the outdoor environment, but rather use "resource kits" which at best are very artificial versions of reality, divorced from living contexts. Planned curricula are short on openness and long on structure and provide only one way to go, i.e., too "blue".

The reaction to overly planned, restrictive and linear curricula has led to the development of packaged open curricula. These tend to start with concepts and leave the teacher and student to develop activities. An elegant example is the Essence Environmental Studies Cards.

Although the E.S. cards have many useful applications, particularly for use with intermediate/upper grade students and in-teacher training, they can be adapted for use with younger children. Many teachers who are more oriented toward the symbolic abstract mode find the process too open, i.e., too "yellow"-like a map of virgin terrain with no roads. Too much freedom is often as difficult a road to take as too little.

We believe the ideal curriculum for general application must have an intermediate balance of both structure and openness, a blend of rational and metaphoric realms, i.e., predominantly "green". Thus the confident teacher is always faced with many options and, conversely, the unsure teacher has some clear guidelines and specifics to fall back on. Intermediate transitional curricula can draw on a great variety of initiating stimuli, some more indeterminate than others. The relatively predictable seasonal cycle will engender a constantly changing flow of possibilities for the Fall, Winter and Spring. On the other hand, day to day changes in the weather are highly unpredictable -- especially in more temperate zones. Each change gives rise to new opportunities.

Weather can be included in the general category of serendipitous, fortuitous and unintentional events. However, without an open, holistic, adaptive curriculum, many opportunities will pass by unnoticed and, unfortunately, unexpected. Serendipitous opportunities will arise because of new environmental resources. For example, in WEY the presence of mud or wet soil provided home building material for cliff swallows which then proceeded to build their gourd-shaped mud nests under the eaves of the school roof.

STARTERS AND INPUTS

	PACKAGED CURRICULA	PHYSICAL RESOURCE	RESOURCE PERSON	ACTIVITY-FOCUSED
C	Useful place to start if you can afford the price. Indoor-oriented but can be adapted to the outdoors, SCIS, ESS, etc.	Activities suggested by a specific resource, e.g., ponds, animals, climbing structure.	Someone from outside with special skills, knowledge and experience of working with kids.	What you do becomes the medium, as field-trips, camping, harvesting, climbing....
D	Traditional prescriptive design processes, viz., analysis/synthesis and implementation	Creation of such resources on site.	Designer as such ...but also recognition of other 'experts.'	

	SEASONAL	CHANGE-ORIENTED	SPECIAL EVENTS
C	Predictable cycles of climate and social behavior.	Applies to some changeable elements more than others, e.g., gardens and planting, shelter building, art and creativity, changing perceptions, behavior and values.	Traditional community affairs and/or new social inventions: festivals, carnivals, street theater.
D	Exploitation of potential embodied in seasonal change. The 'indicative' environment.	Setting up changeable space.	Helping them to happen.

	CHILD-INITIATED	PARENT-INITIATED	COMMUNITY-INVOLVED
C	Suggestions from children or stimulation from an object, e.g., pets.	Something stimulated by parent at home or elsewhere that carries over to school.	Off-site visits and activity at community facilities and organizations, e.g., fire station, city hall, neighborhood trips and the resource people there.
D	Children as clients.	Parents as child-representatives.	Community as a planning/design resource.

	GENERIC THEMES	UNINTENTIONAL	FORTUITOUS	SERENDIPITOUS
C	E.g., holes, hills, edges, patterns, territories, entrances, paths, tunnels.	On the look-out for spin-offs from pre-established activity.	Fortuitism: the doctrine or belief that adaptations in nature come about by chance and not by design.	C/D A quality residing inside the teacher/designer; the faculty of making desirable but unsought-for discoveries. The inevitable result of trained senses and awareness.
D	Making sure these elements are built-in.	The unforseen extensions of previous actions.	C/D Making the most of happy accidents.	

The 'art of openness'...not letting life pass you by...recognizes that you don't have the answers preconceived in your mind...applying equally to education and design.

STARTERS AND INPUTS FOR CURRICULUM (C) AND DESIGN (D).

Starting stimuli are many and varied; closed to open, intentional and unintentional. They are all legitimate. The paths you choose will depend on who you are and your situ- All the stimuli have an equivalency in various modes of design and intentional change.

CURRICULUM CONNECTORS

The following represents a guiding framework for generating/coding environmental education activities.

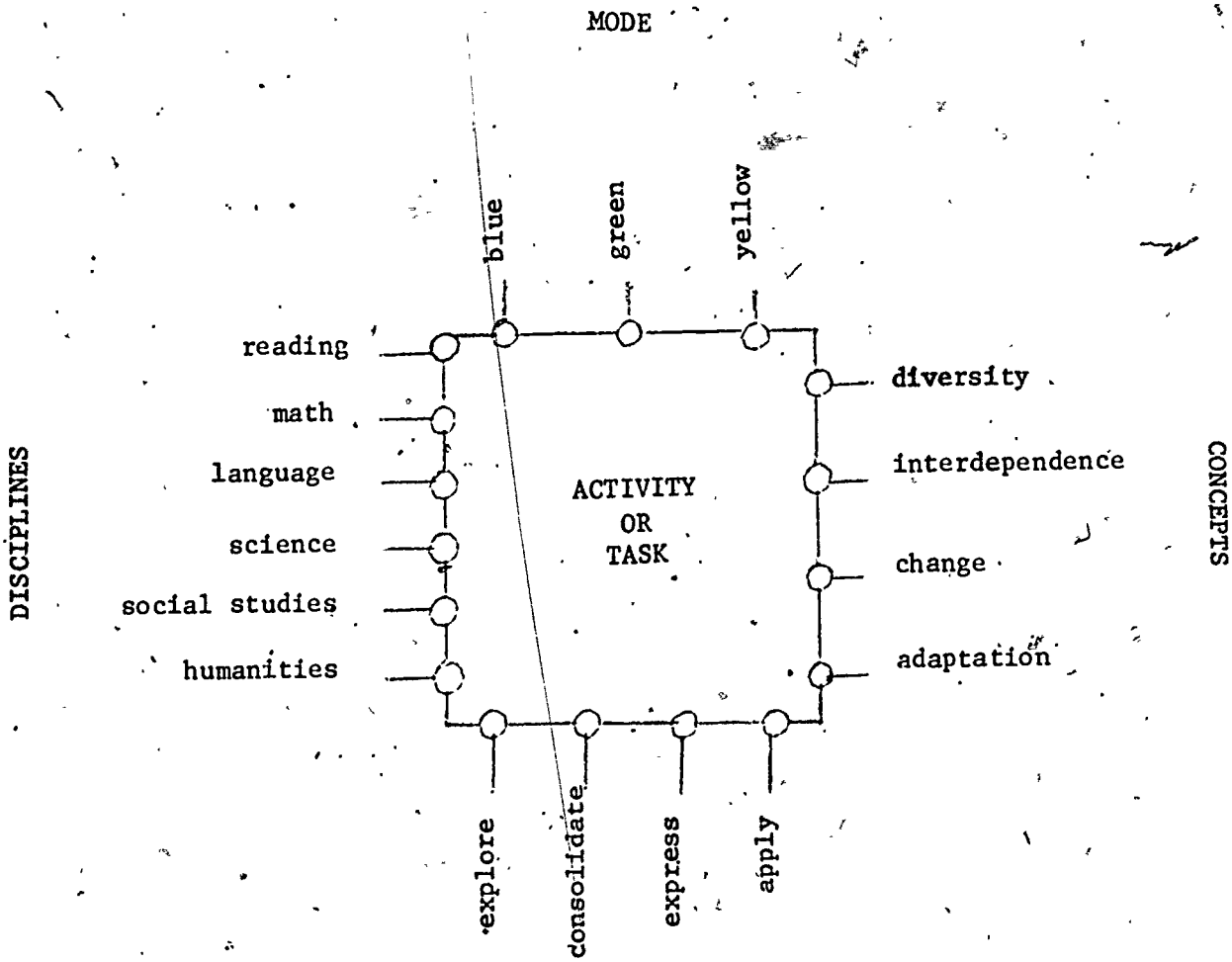


FIGURE 1. ACTIVITY SWITCHBOARD

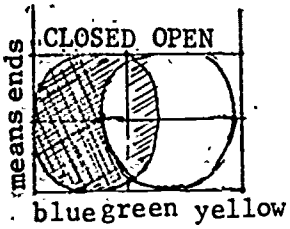
Provides a coding system for play-and-learning activity, indicating inherent possibilities given by the "big four" curriculum connectors, defined below.

MODE

This group of codes cues the teacher/child into the character and degree of the value criteria of flexibility and constraints for every activity. There are tonal gradations within and between the symbolic color guidezones and most children will need some mix of all three modes of play-and-learning experience -- from the most predictive, homogeneous and specified to the most evocative, diverse and exploratory.

Learning Activity

Blue = prescribed, isomorphic, formulated approach/means/process to a prescribed, formulated objective. There is no modification or alternative to the closed box of means (how to proceed) or the ends (what results are expected). Therefore, it is a 'closed/closed' mode.



Green = prescribed, unambiguous, specification of the end, but the means is open for choice. Likewise the inverse of the means/ends is applicable, i.e., the means is prescribed and closed, but the end is open to choice. Therefore, it is a 'closed/open' or 'open/closed' mode.

Yellow = both means and ends are open as a viable choice. Non-prescriptive, non-predictive. Therefore, it is an 'open/open' mode.

Play Activity

Blue = fully prescribed, standard, traditional play equipment, asphalt and chain-link fencing; surroundings which embody a standard, limited, unchanging repertoire of behavioral responses. Closed environment/limited behavior.

Green = partially prescribed setting, e.g., an adventure playground, embodying a much larger repertoire of behavior, but still within limits. Open environment/limited behavior.

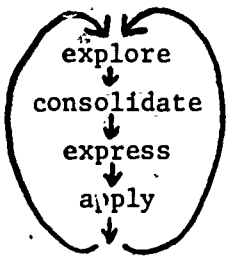
Yellow = unprescribed setting, e.g., vacant land with a mix of people-made and natural elements, where there are no adults and no limits. Open environment/unlimited behavior.

DISCOVERY CYCLE OR INVOLVEMENT PROCESS

Environmentally-based learning starts with direct experience in a progression from action to intuition, from concrete to abstract, and from fact to theory. Creative play behavior often seems to follow a similar sequence. The cycle is a restatement of the design profession's overworn analysis-synthesis-implementation cliche; here it is presented as a continuous spiral through time. Unless it exists in conjunction with the other three 'connectors' the process is qualitatively meaningless.

Learning activity

Exploring Activities: Observing, manipulating and freely exploring/investigating materials (stuff), messing around to see what it's like to handle things, or seeing 'what happens if...' Investigative activities.



Conceptualizing Activities: Consolidation of learnings, via new concepts, to aid in compilation and interpretation of observational data. Activities include examples of a new concept to reinforce, consolidate -- or contradict -- preconceptions.

Expressive Activities: The communication of children's exploration and discoveries and consolidations through expressive media -- graphs, charts, stories, role-playing, demonstrations, model making, dramatics, etc.

Applicative/Evaluative Activities: Involvement with a variety of illustrative examples that provide feedback and the recycling of learnings to new situations; an evaluation medium.

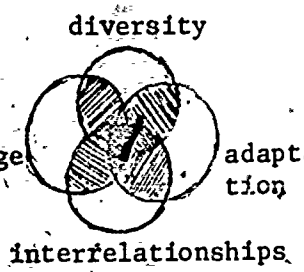
Play Activity

In an 'open' setting, play activity has a similar sequence, starting with free exploration of the given environment; leading to a selection of particular spaces, objects and materials to work with; which results in specific 'constructions,' games and expressive behavior; and eventually a further stage of re-application of the 'learned pattern' to a new setting and the on-going 'culture of games.' In a 'closed' play-setting, possible sequences are severely curtailed by a 'cultural routine.'

DIAC, CONCEPTS

Diversity, Interdependence, Adaptation and Change are the basic environmental/ecological concepts underlying nature and society that apply to all living systems. Their application to childhood and education seems highly appropriate.

D: A study of diversity gives children a chance to observe, sample, compare and classify/organize what they perceive in their total environment. The concept reflects the perspective of the vastness and complexity of the environment. Patterns, similarities and differences are basic elements embodied in diversity.



I: Interdependence/Interrelationships/Interactions is one of the most important concepts. Children need opportunities to experience interdependent linkages. They need to perceive and feel the impact of how everything is connected to everything else, that disrupting one element causes a disruption of the elements of the entire system. Food chains and webs, social configurations, art mobiles, a string quartet or a jazz trio, or turning the compost, are all environmental contextual examples.

A: Adaptation is a pervasive concept that children must have an opportunity to develop. Since adaptation relates to how organisms adjust to environmental conditions, the way children adapt or cope with themselves and others in a social environment in school, home, on the streets, etc., is an everyday affair. The concept of adaptation is more rapidly developed as children conceptualize diversity and interdependence. Essentially, both structural and behavioral adaptations make up the core of the concept.

C: Change is the only constant in nature. Children need to experience the incredible array of changes occurring in and about them. They need to experience the variables of change. Successional characteristic of change as a fundamental is replete with examples in the indoor/outdoor environment. Attitudinal and behavioral change by children and adults are likewise developed in phases.

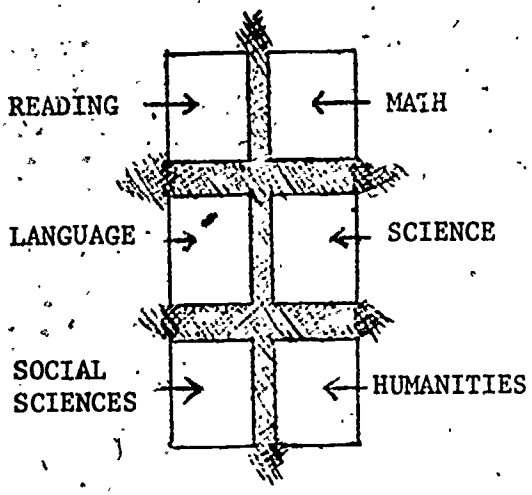
Play Activity

High quality, open play environments allow children to develop an independent intuitive grasp of the DIAC concepts.

A diverse environment stimulates diverse behavior; an open natural/people-made setting allows for direct manipulative changes, incorporating change-cycles of weather and climate. Since interactions with the environment are unrestricted, users can open up and explore an endless variety of possible interrelations between themselves and their surroundings; over the course of time this leads to new adaptations between users and environment and the evolution of intuitive environmental values based on experience.

DISCIPLINES

A restatement of the spectrum of curricular disciplines. Its inclusion is aimed at increasing awareness of the interdisciplinary nature of most experiences and to motivate planning to pick-up on holistic spin-offs leading to extended, instructional activities.



Learning Activity

R = Reading

M = Math

L = Language Arts

S = Science/Health

So= Social Studies

H = Humanities

O = Other

Play Activity

Environmentally rich, open play settings generate rich, complex patterns of behavior, which in themselves are rich interdisciplinary expressions of language; numeration; scientific testing of limits and combinations; creative dramatization and artistic, humored 'productions'; all as holistic expressions of individual/group/community values and relationships between themselves and their surroundings.

REFERENCES

Amara, Roy. "Education for Survival: Some Necessary Cognitive, Participative and Perceptual Changes for America's Third Century," Phi Delta Kappan, Bloomington, September, 1976.

Boyer, William H. "Toward an Ecological Perspective in Education, Part II," Phi Delta Kappan, Bloomington, February 1974.

Bruner, Jerome S. On Knowing: Essays for the Left Hand, Atheneum, N. Y., 1971.

Bundy, Robert F. "Social Visions and Educational Futures," Phi Delta Kappan, Bloomington, September, 1976.

Campbell, Colin. "Coming Apart at the Seams: An Interview with Robert Heilbroner," Psychology Today, February, 1975, p.97.

Craig, James H. and Marge Craig. Synergic Power: Beyond Domination and Permissiveness, Proactive Press, Berkeley, 1974.

Eisner, Elliot W. and Elizabeth Vallance (Editors). Conflicting Conceptions of Curriculum, McCutchan, Berkeley, 1974.

Ferkiss, Victor. Technological Man: The Myth and the Reality, Braziller, N. Y., 1969.

Fromm, Eric. To Have or to Be? Harper & Row, N. Y., 1976.

Harman, Willis W. "Seis-ing Up the Social Revolution," Phi Delta Kappan, Bloomington, September, 1976.

Hawkins, David. The Informed Vision, Agathon Press, N. Y., 1974.

Illich, Ivan. Tools for Conviviality, Harper & Row, N. Y., 1973.

Lynch, Kevin. What Time Is This Place? MIT Press, Cambridge, 1972.

Phenix, Philip H. "Transcendence in the Curriculum" in Conflicting Conceptions of Curriculum, ed. Eisner and Vallance, McCutchan, Berkeley, 1974.

Postman, Neil and Charles Weingartner. Teaching as a Subversive Activity, Delta, N. Y., 1969.

Reilly, Mary (Editor). Play as Exploratory Learning: Studies of Curiosity Behavior, Sage Publications, Beverly Hills, 1974.

Samples, Bob. The Metaphoric Mind: A Celebration of Creative Consciousness, Addison-Wesley, Menlo Park, 1976.

Shane, Harold G. "America's Next 25 Years: Some Implications for Education," Phi Delta Kappan, Bloomington, September, 1976.

Theobald, Robert. Habit and Habitat, Prentice-Hall, Englewood Cliffs, 1972.

UNESCO-UNEP. "The Belgrade Charter: A Global Framework for Environmental Education," UNESCO, Paris, France, January, 1976

Wong, Herbert H. "Ontogeny of an Urban Environmental School Yard Ecosystem," Nature Study, Vol. 29, No. 1, Spring, 1975.

Wong, Herbert H. "Environmental Value Change Via Creation of Environmental Schoolyard Ecosystems," NAEE in Current Issues in Environmental Education II, Ed. Robert Marlett, ERIC/SMEAC, Columbus, 1977.

Young, Donald, Robin C. Moore and Herbert H. Wong. Washington Environmental Yard: An Environmental Education Tool, Description and Assessment, Final Report to HEW, Office of Environmental Education, December, 1976.

PROJECT ECO
AN ENVIRONMENTAL CURRICULUM OPPORTUNITY

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Introduction

Schools, as they have been organized traditionally, have emphasized abstract learning in fabricated situations. Our message to students has been that learning is something that happens inside schools. Rather than take advantage of adventures in reality, we have found it easier to have students listen, or read, or look at pictures. This basic method of operation found in most schools creates a serious impediment when the subject is environmental education, which should be recognized as one of our nation's major curriculum concerns.

Barry Commoner, speaking before the 13th National Conference of the U. S. National Commission for UNESCO, introduced the "ecological facts of life":

> The ecological facts of life are grim. The survival of all living things -- including man -- depends on the integrity of the complex web of biological processes which comprise the earth's ecosystem. However, what man is now doing on the earth violates this fundamental requisite of human existence. For modern technologies act on the ecosystem which supports us in ways that threaten its stability; with tragic perversity we have linked much of our productive economy to precisely those features of technology which are ecologically destructive.
>
> These powerful, deeply entrenched relationships have locked us into a self-destructive course. If we are to break out of this suicidal track we must begin by learning the ecological facts of life. If we are to find the road to survival, we must discover how to mold the technology to the necessities of nature, and learn how these constraints must temper the economic and social demands on technology. This, I believe, is the momentous task which now confronts mankind.[1]

His statements are succinct and apply directly to the concerns of Project ECO. These "facts of life" must be woven into the fabric of every child's education, and education's responsibility begins as the child enters school. The intent of this project is to increase the student's involvement with the natural environment in an organized manner and with some identifiable learning outcomes.

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[1] Barry Commoner, "The Ecological Facts of Life", No Deposit -- No Return, ed. by Huey D. Johnson, (Reading, Massachusetts: Addison-Wesley, 1970), pp. 18-19.

To formulate plans for the project, sessions were conducted involving teachers, Iowa State University faculty, and representatives from such agencies as the ISU Environtology Council, the Ames Audubon Society, and the Iowa Conservation Commission. This resulted in the creation of a writing committee which drafted a proposal for the project and submitted it to the Ames Community School Board of Directors in November 1970. Receiving Board approval, the proposal was then submitted to the Iowa Department of Public Instruction and subsequently was approved for funding through Title III, ESEA, in the spring of 1971.

In order to facilitate the purpose of the project, which is to broaden and enrich the base of activities in the Ames Community Schools related to the understanding and preservation of the environment, four components have been developed -- the first, an outdoor living 'laboratory" on a school site. Through community efforts directed by the principal of Fellows Elementary School and landscape architects at Iowa State University, plans were developed for plantings, which, when completed, will consist of an ecological balance of the flora and fauna native to Iowa, and also will serve as an example to others of the importance of preserving the natural contours of a new school site.

The second component, a combination transportation unit and mini-lab, was developed to link the school and the field experience. A 72-passenger bus was purchased and remodeled to seat thirty students, with the remaining space equipped with storage cabinets, tool chests, equipment drawers, and counter space. This was accomplished while still maintaining safety standards as outlined by the Iowa Department of Public Instruction.

The third component is a mobile laboratory fashioned from a used forty-foot semi-trailer. This component has made it possible to get people out of the "learning-takes-place-in-a-classroom-in-a-building" mind set that seems so counter-productive to many of education's concerns today. A talented maintenance staff in the district was able to remodel the trailer without a prohibitive cost. This laboratory allows students to investigate environments not readily available within the immediate school community. Beyond providing a variety of sites, the mobility factor is important to the concept of Project ECO in that it allows environmental stress in a study area to be relieved at appropriate intervals.

While a prime or overriding goal of the project was stated as:

> Students will engage in activities appropriate to their level of maturation which will include observation, investigation, and evaluation of a variety of ecological relationships and conservation practices in central Iowa in order to develop the concept of stewardship of natural resources,

the second major goal was to have teachers support and assist in the accomplishment of that first goal. That leads, of course, to the fourth component of the project, teacher inservice education.

Prior to beginning a class level program, the teacher of that level is released from duties to spend one-half day on the site to be visited by the class, and receives instruction specific to activities appropriate for that site and season. Since trips are taken by students in Grades 1, 3, 5, 7, and 9 during three different seasons of the year, teachers' workshops are appropriately spaced. These sessions not only assist the teachers in the preparation of the class for the experiences, but also gives them confidence that they can operate effectively in a setting different from the classroom.

A more subtle, but equally important, part of the inservice program is the actual field trip with the teacher and the class. This provides the teacher with an opportunity to observe the project staff member as a model, not just for the techniques of presenting information, but as a master teacher in such areas as the relationship established with students and the creation of an open, discovering environment for learning. Thus, the twelve hours a year in direct instruction in the field is coupled with another eighteen hours of modeling behavior while the teacher is in the field with the class.

With this component, teacher inservice education, came the goal of developing a staff that was competent and committed to emphasizing environmental awareness and to operating in learning situations outside the classroom. This meant that initially we had to hire an ECO staff who had these talents, who could lead inservice work with teachers, and who would provide the appropriate modeling behavior for teachers in the field. By the second year, as we added the second mobile unit, we had two and one-half staff members, all with Master's Degrees in Science and with excellent experience. We have now evolved in our training of teachers to the point where we have one full-time professional staff member, Mr. Frazier, and two teachers aides who drive the bus to the field and assist the teacher, who now is responsible for the ECO activities. As we had predicted, this now assures the continuity of learning experiences for children and provides them a much more integrated view of in-school/out-of-school education.

Student Activities

Project ECO is currently in its sixth year of operation and is providing a planned, coordinated exposure to environmental processes in the immediate area. The program formally begins at the Primary II and III levels with a variety of awareness-producing activities during three all-day field trips to different natural environments around Ames. Activities at the Primary II and III levels may include the following: 1) looking for animal homes; 2) looking for likeness and difference between similar items; 3) observation and discussion of leaf galls; 4) observation and discussion of allergy-causing plants such as poison ivy and ragweed; 5) counting acorns or hickory nuts; 6) mapping "mole" tunnels; 7) learning all one can about a "favorite" tree; 8) psychomotor activities such as sawing wood or rowing a boat; 9) fishing with a cane pole; 10) predicting shadow movement on a sundial; 11) building an "Indian" log house. The list could go on and on, for the teachers are limited only by their imagination and willingness to spend the time to introduce various concepts to their students.

The Primary IV and Intermediate I levels expand the awareness activities to include focus on certain skill activities also. Awareness activities requiring skill development might include the following: 1) sawing a thin section from a tree trunk to determine the age of the tree by counting tree rings; 2) taking temperature and wind velocity readings at various locations to determine the effect of vegetation, slope, color of surface, etc.; 3) psychomotor skills involved in the use of binoculars and simple microscopes; 4) collection techniques; 5) use of simple dichotomous tree keys to identify evergreens; 6) studying near a beaver dam to learn how to make value judgments concerning environmental decisions. Again, the focus is on awareness with a blending of skill development at the middle childhood level.

The Intermediate II and III levels bring about a focus on the application of skills that are best taught out-of-doors with an awareness of the environment. These activities include: 1) orienteering, which facilitates instruction in compass and map interpretation; 2) interpretation of existing ecosystems; 3) mathematics, rock study, creative writing, and social studies in a local cemetery; 4) simple water studies using prepared kits for chemical analysis; 5) plant population studies;

6) introduction to paleo-environment studies; and 7) study in detail of at least one natural resource. The Intermediate level also is introduced to night environmental studies via an overnight stay at the State 4-H Camp where emphasis is on conservation and social development.

Seventh grade activities fit into three main areas: 1) a social studies field trip that focuses on the pioneer development of the area and their dependence on the environment and natural resources of the area; 2) a winter lake study which includes making a profile of the lake's bottom and measuring the turbidity, depth, temperature, dissolved oxygen, dissolved carbon dioxide, pH and plankton population; and 3) the emergence of plant and animal populations during the spring. Development of these activities has been accomplished by working with the classroom teachers to relate the outdoor work to concepts that have been or will be covered in the classroom.

Ninth grade activities are under the direction of the earth science teacher, and major emphasis is placed on fossil study, paleo-environment, rock correlation and landforms. These studies, then, are related to their impact on the total environment and economics of the Ames area.

ECO activities at the high school level are coordinated with the leisure time classes in physical education and include weekend campouts, bowling, roller skating, etc. A summer course, Environmental Studies, includes a twenty-day trip to the west with stops at such places as the Badlands, Black Hills, Big Horn Mountains, Yellowstone, and the Tetons. A wide variety of ecosystems can be studied on this trip.

New instructional guidelines published by the Iowa Department of Public Instruction call for the teaching of "conservation of natural resources and environmental awareness" at all grade levels, one through eight. Project ECO has been attempting to help teachers of this state develop materials and expertise to meet these new guidelines by conducting workshops in the field and working with several writing teams in the development of curricular materials for their schools.

Research

It may be sufficient in this time of accountability to merely state that the results of Project ECO have been so significant that next fall the school district will have carried on the project four years after the Title III seed money ran out--this, in a system whose budget is not in good shape due to the Iowa foundation finance plan and declining student enrollment. This has required the closing of schools, restriction of some programs and tension in collective bargaining with teachers. The fact that ECO could maintain its present level of operation virtually unquestioned may speak to its viability more strongly than any amount of "learning research" which could be conducted.

And yet the first few years of the Project, with the obligation to research inherent in Title III, did provide sufficient indication of its worth that it was approved by the USOE validation process. Despite the fact that an ISU graduate student, Harold Hulleman,[2] wrote a dissertation as a part of our evaluation effort, initial research activities were not overly sophisticated. Such was the state of

[2] Harold W. Hulleman, "Effects of In-service Training on Elementary Teachers Pertaining to Science Achievement and Attitudes Toward Environmental Science", (unpublished doctoral dissertation, Iowa State University, 1972), p. 76-81.

the art during the first of this decade. There were absolutely no "standardized measures" which could tell us how to assess an individual's knowledge of the environment, let alone how their attitude about the environment had improved. We used the work of Roth, et al.,[3] to provide a list of concepts we wanted to emphasize in Project ECO and developed an instrument which asked teachers how important they considered the teaching of the concept and how confident they felt about trying to teach that concept. These two scales were designated as 'important-not important' and 'adequate-inadequate' continuums, respectively. Appropriately, after ECO experience, they indicated that they had gained some confidence in their ability to teach these important concepts.

Student learning improved, but it was difficult to assess the effect of Project ECO on that improvement.[4] Experimental group results were impressive the first year, but by the second year and continuing through the present, the entire system became involved in ECO. So, despite the subjective data of community, student, and staff support of Project ECO, it was not until the fifth year of operation that we could develop, with the help of Dr. Fred DeLuca of Iowa State University, an evaluation that might provide a more objective view of learning associated with Project ECO.

The latest evaluation of the Project started in the fall of 1975 with the building of three sets of evaluation instruments based on concepts introduced by Project ECO. One part of each set included an evaluation of knowledge about environmental concepts and the other part included an evaluation of attitudes concerning the natural environment. Items were selected for the various instruments and subsequently evaluated by a team of classroom teachers. Items were then selected from the original pool that met the standards approved by the teachers for the various grade levels. Pilot instruments were then constructed for the elementary, junior high and senior high levels. These pilot instruments were administered to a selected sample, scored, analyzed and rewritten, in part, for administration to the Ankeny, Iowa, and Ames, Iowa, students at grades four through twelve.

Ankeny was picked as a control site because the Ankeny school system had no formal environmental curriculum at the time, but had plans to introduce such a curriculum and could use this study as a basis for further evaluation at a later date. Support for the study was received from the Ankeny administration, and this support was transformed to the classroom teacher so well that few, if any, problems arose. We were restricted from using individual names and standard scores for the Intermediate (Grades 4-6) levels. We were able to correlate standard scores at the upper grades between the two school systems.

In all cases, the instruments were administered by trained personnel to the Ames students first and then to the Ankeny students. This was done to help alleviate any time element in favor of the Ames district and thus increase our "burden of proof". In the case of standardized testing, the Ames tests were all administered in the second week of September with the Ankeny test administered from one to three weeks later.

It should be noted that although the ECO program in Ames begins at the Primary II or first grade level, our evaluation begins at the Intermediate I or fourth grade level. The rationale for this is related to the difficulty in designing an instrument

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[3] Robert E. Roth, Milton O. Pella, and Clay A. Schoenfeld, Environmental Management Concepts--A List, (Madison, Wisconsin: University of Wisconsin, Wisconsin Research and Development Center for Cognitive Learning, 1970).

[4] Luther L. Kiser, Kenneth E. Frazier, Gerald E. Dunn, Project ECO Research Report, Ames, Iowa: Ames Community School District, 1972).

that could be administered to large numbers of early primary students in a reasonable length of time.

At Intermediate class levels, the Ames students scored significantly higher on both the knowledge and the attitude instruments. Standardized test scores were not available, so a definite comparison of the effect caused by Project ECO could not be made. At grade levels seven, eight, and nine, the Ames students continued to score significantly higher on both the knowledge and the attitude instruments, and this difference between the scores of the two schools increased. The standardized test, The Iowa Test of Educational Development, was administered to the ninth grade students at both locations and there was no significant difference in the composite score between the two schools. The trend continues through grades ten, eleven, and twelve, with significant differences at the .01 level for the knowledge and the attitude instruments and with no significant difference at the .05 level for the standardized test.

It is realized that one must be careful in trying to draw too much from the comparisons we have made because we were not able to establish that there was no significant difference between the two schools at the time when the Ames students were exposed to Project activities at the Primary level. Other data collected indicate that the two communities have similar socio-economic conditions as well as educational goals for their students. The evaluation data collected appears to support that general good feeling that one gets when watching students apparently enjoying themselves while in a required learning situation.

The continued support by parents, faculty, administration, and Board members leads us to believe that we have a unique, working model. The model has been successfully adopted/adapted by other school systems, and we continue to make this opportunity available through the Iowa-Nebraska Facilitator Project and our own staff.

A CORE CURRICULUM FOR THE ENVIRONMENTAL DESIGN PROFESSIONS

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Introduction

A. Background

The Faculty of Environmental Design was established at The University of Calgary in 1971. It offers graduate programmes leading to the degree Master of Environmental Design with special qualification in one of three degree options, Architecture, Urbanism or Environmental Science. The presence of the other two related areas enhances and enriches the student experience through exposure to some of the interactions which go beyond professional and disciplinary boundaries. Architecture students gain a sensitivity to the environments, built and natural, in which a building is situated. Urban students gain an appreciation of the built components of the city and of its ecological setting. Environmental science students benefit from understanding the impacts of development at the micro and macro level on the natural environment.

The curriculum is interdisciplinary in its conception, in its operational dimensions, and in its administration. The latter two characteristics are important: the intellectual attitude is accompanied by a firm organizational commitment to implementation. In keeping with the philosophy and approach of the faculty, the curriculum requires students to develop environmental awareness, knowledge and personal skills of thought, analysis and design directed towards a wide range of environmental design issues. Emphasis is placed on professional education with a view to current and future challenges rather than the administrative and functional dictates of government or particular accrediting bodies.[2]

One part of the curriculum is the common core. It is taken by all students irrespective of their chosen degree option. The common core is approached via four mandatory courses totalling 342 contact hours of instruction and studio work. Most students complete the common core over a period of three academic sessions. A second part of the curriculum is a common body of knowledge in the degree/option (architecture, urbanism or environmental science) approached via a general knowledge examination (GKE). The student prepares for this examination by means of a personally designed programme of study which may include work experience, studies at another university, and independent study as well as formal course work. Several courses are offered which aid the student in this preparation, but none are mandatory. In fact no course credits are required except for the common core courses. A third part of the curriculum is the concentrated area. Courses are offered at this level

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1. Although many of our colleagues have made substantial contributions, this paper represents the authors' perceptions of the situations discussed.

2. In fact, our architecture and urbanism graduates are accepted for membership by the relevant professional bodies.

but neither courses nor exams are required. Rather, the demonstration of proficiency is by means of a final degree project which may or may not be in a thesis format.

As students progress through these three parts of the curriculum (as illustrated in Figure 1), the focus becomes narrower and the intensity increases. However, emphasis is placed on a recognition of the broader context as the focus narrows.

B. Reasons for a common core programme

The necessity for a common core programme arose out of the feeling of the faculty that traditional approaches to the Environment Design professions (like the traditional approaches to many professions) have failed, due to a deficiency in understanding fundamental principles, social theories and underlying issues. Traditional approaches have taken a single disciplinary orientation. There have been recent shifts away from a physical orientation towards a social orientation, and the level of rigor has increased with the introduction of analytic techniques. However, even at best the results have been a multi-disciplinary approach,[3] where various practitioners analyze the problem, but each considers only the factors relevant to his own profession or discipline. Even recent modifications to the traditional approaches have tended to present the problems of Environmental Design as essentially technical problems to be solved in a technical manner. The design of an urban area or the design of a building was typically approached as a technical problem, largely divorced from its social, economic, political, cultural and natural contexts. However, most environmental problems are not, in the first instance, scientific or technical in nature, they are social problems. Passmore makes this distinction clear:

> An ecological problem is not, in the first place, the same thing as a problem in ecology. A problem in ecology is a purely scientific problem, arising out of the fact that scientists do not understand some particular ecological phenomenon, how, for example, DDT finds its way into the fat of Antarctic birds. Its solution brings them understanding. An ecological problem, in contrast, is a special type of social problem...To speak of a phenomenon as a 'social problem' is not to suggest merely, or perhaps at all, that we do not understand how it comes about; it is labelled a problem not because, like a scientific problem, it presents an obstacle to our understanding of the world but rather because -- consider alcoholism, crime, deaths on the road -- we believe that our society would be better off without it.[4]

Environmental problems are social problems. What is required is not merely an understanding of how these problems come about, but an understanding of the ethical, political, economic and cultural framework within which they are considered to be problems and within which solutions can or cannot be devised. Thus, at the

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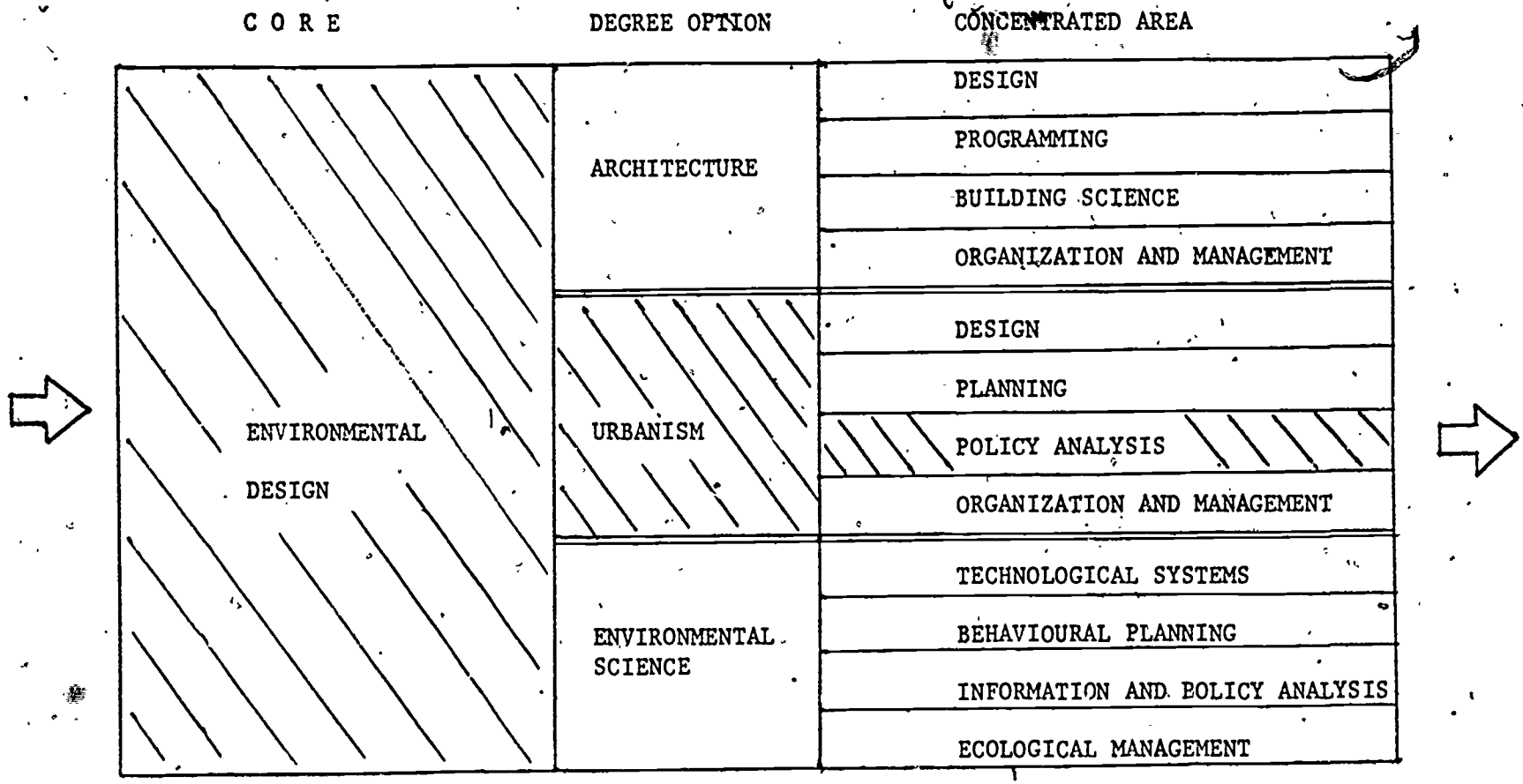
3. For a discussion of this distinction, see J. McKellar and S. M. Stein, "Interdisciplinary Education for the Architect", Journal of Architectural Education, Vol. XXIX, #3 (February 1976), p. 34.

4. J. Passmore, Man's Responsibility for Nature (London: Duckworth, 1974) p. 43.

FIGURE 1: THE THREE PARTS OF THE CURRICULUM



Faculty of Environmental Design it was felt that we must not approach environmental issues as solely technical or scientific issues seen from one disciplinary perspective. The issues must be understood in terms of their relationship to the social framework as well as the technical and environmental framework within which they arise. Such an interdisciplinary approach requires an entirely new perspective which is integrative and all-encompassing.

Our core curriculum attempts to give students in all three degree options an interdisciplinary approach which goes beyond the uni- or multidisciplinary approach to environmental problems.

What follows is a discussion of our original core curriculum: its objectives and component courses, the difficulties encountered and ensuing modifications; followed by a discussion of our new revised core curriculum. This new core reflects a number of design principles based on our experience with the original core, plus a more complete and better-structured set of objectives.

I. Original core curriculum

A. Original Objectives

The objectives of the original core curriculum involved an understanding of:

1. Man
2. Natural and built environments
3. Man/environment relationships
4. Societal relationships
5. Culture, language, and institutions governing intervention
6. Impact of cultural institutions on the study of #1 to #4
7. Technology and its impact
8. Analytic techniques
9. Interdisciplinary group problem-solving and design; the applications of knowledge and skills #1 to #8
10. Attitudes and values particularly in relation to #9

B. Component Courses

To achieve these objectives, six mandatory courses were devised:

Course A: Human Adaptations.
(36 contact hours over one twelve-week session)

Study of man as a biological entity set within a framework of his biologic history and limitations; conducted in a laboratory setting, covering the normal biology of man and common physical and psychic malfunctions. The objective is to demonstrate the limitations of human adaptability which have to be respected in environmental planning and architectural design.

Course B: The Biosphere as a Physical System,
(72 contact hours over one session)

Studies of the dynamic states of the biosphere with reference to laws of physical science: ways and means of monitoring

environmental change examined in reference to physical, chemical, and organic indicators; illustrations of contemporary problem/research areas; predictability and utopian control systems discussed in reference to current forcasted technologies.

Course C: Cultural Processes in Environmental Design.
(36 contact hours over one session)

Cultural agencies, philosophical presuppositions and the concept of life-forms studied in relation to Man's attempts to control the environment; critical appraisal of the value systems underlying the disciplines involved in studying man-environment relationships; man's potential for effecting environmental norms studied with reference to scientific theory, linguistics and human communications.

Course D: Techniques of Environmental Analysis.
(72 contact hours over one session)

Introduction to techniques of analysis in environmental design, descriptive and quantitative predictive methods in application to human and other ecologies; the concept of systems, theory and techniques of system description and analysis, their utility for environmental problem solving; selected techniques of statistical analysis and computer programming including development of Fortran language capability; special application to statistical analysis and systems models.

Course E: Environmental Design Practice.
(144 contact hours over two sessions)

Introduction to environmental design practice conducted mainly as a workshop; study of the scope and nature of environmental design problems; discussion of the kinds of intervention and practices of the various agencies engaged in control of environments; interdisciplinary projects developed around three themes: analysis, design and communications, and policy formulation; issues in environment management investigated mainly in reference to current practices in large-scale planning projects. Lectures, Seminars, Projects.

Course F: Advanced Environmental Design Practice.
(72 contact hours over one session)

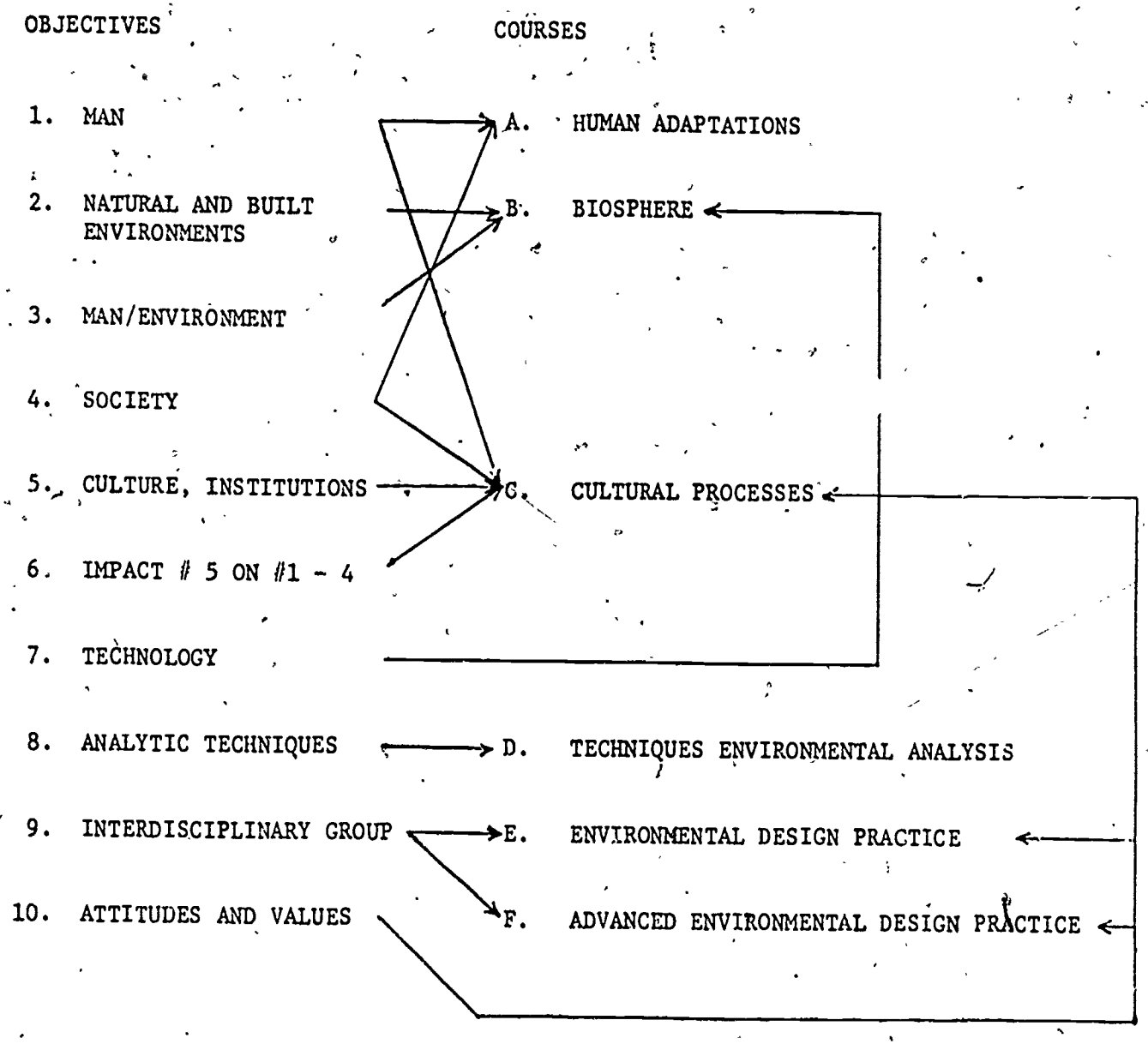
Interdisciplinary training in environmental design practice at an advanced level, centered on case studies, information probing and analysis; culminates in a policy planning assignment and environmental design presentation on a real world problem. Prerequisite: Course E.

The relationships between objectives and courses are shown in Figure 2.

C. Difficulties encountered

Over a four-year trial, a number of difficulties were encountered, particularly with the lecture courses. No course sequence was required or recommended.

FIGURE 2



Students could, and did, take courses in many different sequences and at very different times in their programmes of studies. Thus no common background could be assumed in any core course.

The core lecture courses A, B, C and two parts of course D (quantitative analysis and computer applications) were each taught independently by one or two (different) instructors. An interdisciplinary approach was not developed. There was insufficient interaction between course instructors and little synthesis of material. Conflicting approaches were taught, but not resolved. For example, conflicting views of man and society were taught in courses A and C without giving the student a framework for investigating and resolving such conflicts.

In addition, some serious gaps in the original course structure were perceived: the built environment, political/economic institutions and different approaches to intervention were not included. Other topics formally included in course descriptions were not in fact covered. Instructors tended to take a narrower approach in the courses than originally envisioned. Individuals and their viewpoints came to be closely identified with "their" core courses.

Finally, the studio course E emphasized skill development rather than the application of knowledge gained in the lecture courses. This was partly a consequence of the fact that these courses were not prerequisite to the studio. The studio course F was generally considered successful. Students were usually fairly well prepared by the time they reached this course.

As a result of the foregoing difficulties, many students failed to appreciate the relevance of the core to their chosen profession. Objections were raised to both the content and the time requirements of the core.

D. Modification

Some of the difficulties encountered resulted in substantial modifications to individual core courses during the trial period. For example, in course D it was decided that an appreciation of the strengths and limitations of computers could be better conveyed by teaching the use of a number of application packages rather than by teaching a programming language.[5] In course C, the discussion of ethical principles was substantially expanded. However, after four years it was decided that some of the difficulties were inherent in the original approach and could be resolved only by a major revision.

One of the principal motivations for revising the core was that the goal of an interdisciplinary approach to environmental design problems rather than a multidisciplinary approach had not been achieved. At the root of this failure is the fact that most of the faculty members come from a single traditional discipline. Some have experience as contributors to a multidisciplinary project. Few have engaged in the critical examination of the presuppositions of their own and other disciplines necessary to construct a common ground: an integrative conceptual framework. The new core should seek to bring differing faculty perspectives together in a setting that would stimulate both faculty and students to construct a common framework.

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5. For an extended discussion, see W. A. Ross and L. O. Sinkey, "An Introductory Computer Course for Environmental Design", (unpublished, Faculty of Environmental Design, University of Calgary).

II. The new core curriculum.

A. Objectives and Structure

The new modified core attempts to take an integrated and interdisciplinary approach to the foundations of environmental design which provides a synthesis which did not exist in the original programme. The objectives were specified in somewhat more detail, revised in the light of the difficulties encountered, and grouped under three broad headings.

1. Conceptual Approaches

The student should develop an understanding of the differences and similarities between various disciplines and professions and be able to examine their assumptions critically. The student should appreciate the value of:

a. Practical reason: logic and argumentation, critical thinking
b. Types of investigation: scientific, mathematical, systems, social and cultural
c. Modes of intervention: design, planning
d. Justifications for intervention

2. Knowledge

The student should have an understanding of facts which shape and constrain intervention, and the disciplinary sources of this knowledge, in particular concerning:

a. Man: as a biological, rational and social being
b. Society: as a framework for the protection and fulfillment of man's aspirations
c. Environments: natural and built
d. Man/environment interactions

3. Professional Skills and Techniques

The student should be introduced to skills and techniques which will be developed in professional practice, in particular:

a. Analytic techniques: quantitative analysis, research methods computers
b. Interdisciplinary group problem-solving and design processes
c. Communication: written, oral, graphic, photo
d. Organization and management of time and resources

B. Principles

Our experience over the past five years and the experience of other similar efforts convinced us that certain principles should be followed in designing and delivering courses to accomplish the foregoing objectives:

1. A vast range of topics could conceivably be included in an environmental design core. It is essential that only those elements which provide an understanding of the basic foundations of environmental design be included in the core. The fact that a particular technique or bit of

knowledge was required for a majority of students in one or more areas of concentrated study is not sufficient grounds for its inclusion in the core. Core material must be restricted to those elements which make up the foundation and underlying principles of environmental design.

2. The various knowledge areas are highly interrelated and should therefore be delivered within a unifying framework. Without such a framework some of the problems previously discussed seem inevitable. The subject matter is likely to be taught in a fragmented manner, with insufficient synthesis, insufficient exploration and critique of assumptions, and no satisfactory resolution of conflicting views and approaches. Attempts at interdisciplinarity thus tend to degenerate into multidisciplinarity in practice.

   One role of the core is to bring differing faculty perspectives together in a setting that stimulates not only students but also faculty to construct their own common framework.

3. Conceptual approaches and areas of knowledge are inseparable. Both should therefore be delivered in a common interdisciplinary framework. Much of what is considered to be objective environmental data is in fact conceptually related to a particular disciplinary approach. The conceptual approach often determines (at least partially) the facts which are "discovered". A fractionated or even a multidisciplinary approach to environmental problems will necessarily skew both the descriptions and evaluations of problems towards the particular disciplines employed. These inherent biases must be avoided in the search for adequate solutions. The only way which offers some hope of avoiding them is an interdisciplinary approach.

4. Analytic techniques can be delivered separately from other skills, from conceptual approaches, and from areas of knowledge.

5. Appreciation of the limitations of analytic techniques is enhanced by an understanding of conceptual approaches. The course encompassing conceptual approaches should thus be a pre or corequisite for analytic techniques.

6. Analytic techniques should include the ability to use computers combined with an appreciation of their strengths and limitations. However, this does not imply that a programming language (such as FORTRAN) need be learned.

7. The rest of the professional skills (other than analytic techniques) are best approached via the studio mode.

8. Studio assignments should explicitly recognize and seek to apply the understanding gained in the rest of the core. The course(s) encompassing conceptual approaches and areas of knowledge should be a pre or corequisite for the studio course(s).

9. Two possible types of studio course are useful: a number of small problems of short duration with emphasis on skill development; and a single problem of longer duration with emphasis on production of a professional "product".

10. A common first-year student experience is desirable. Therefore, at least one of the core courses should be required of all first-year students.

C. Component Courses

One entirely new course (I) replaced courses A, B, C in the original core. The other three courses (D, E, F) were retained with some modifications as courses II, III, IV. The relationship between the new objectives and the new courses are shown in Figure 3. Topical outlines of the courses are included in Appendix A.

1. Course I: Conceptual Bases of Environmental Design
(96 lecture hours over two 12-week sessions)

Conceptual frameworks for design intervention in the environment based on perspectives from the humanities, and the natural and social sciences, of man's relation to his natural, social and built environments; theories and models of investigation and intervention; discussion of professional responsibilities and environmental design issues. Required course for all first year students.

The purpose of this course is not to present a series of mini-courses consisting of unrelated facts, but to give the student an understanding of basic conceptual frameworks. The aim of this course is to equip the student to approach environmental design problems with an understanding of the social, political, economic and ethical frameworks in which they arise, as well as an appreciation of the natural constraints on their solution.

In an international context, the discussion of social institutions would have to be adapted to focus on whatever paradigms and historical developments are relevant to the context. One of the essential aims of this course is to equip the student to distinguish between those aspects which are culturally relative and those which are not.

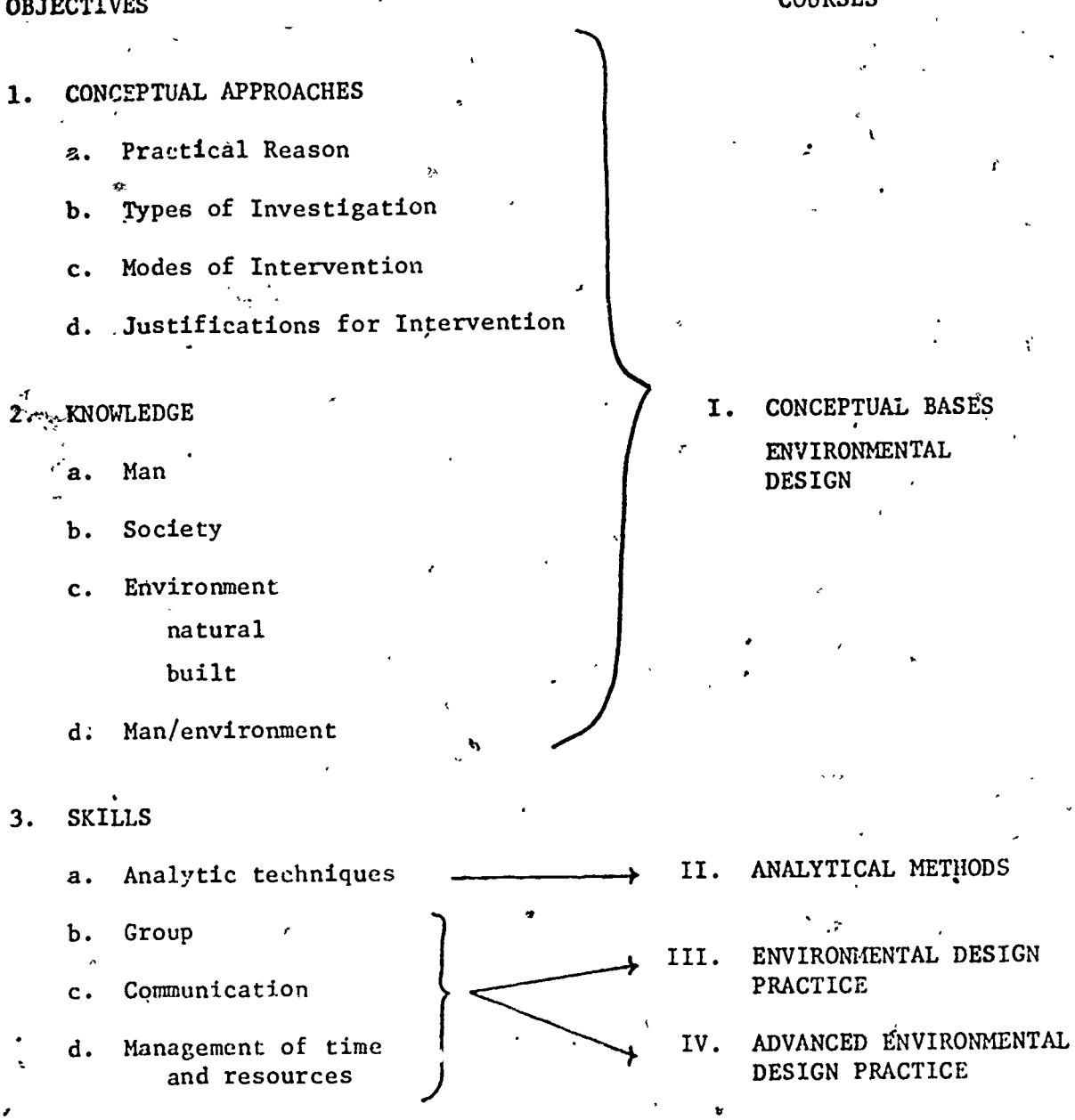
Several provisions are made regarding the presentation of Course I which are intended to enhance interdisciplinarity. Lectures are presented by a number of different faculty with different academic and professional backgrounds. All faculty involved are full-time with the Faculty of Environmental Design. At least three (and often more) faculty members are present at each lecture. Lecture details are worked out by a committee of all Course I instructors. One instructor is designated course manager with the responsibility of ensuring that all lectures conform to the intent of the course. Other faculty members are encouraged to attend as observers and commentators.

In addition, the seminars on "environmental design issues" allow the students to observe the interaction of faculty members and their differing perspectives. The seminars attempt to apply concepts and knowledge gained to particular issues.

Student understanding is evaluated by both examinations and term papers. Informal tutorials are scheduled in response to student requests.

2. Course II: Analytical Methods in Environmental Design
(30 lecture hours in first session, 24 lecture and tutorial hours in second session)

FIGURE 3


OBJECTIVES
COURSES
1. CONCEPTUAL APPROACHES
a. Practical Reason
b. Types of Investigation
c. Modes of Intervention
d. Justifications for Intervention
2. KNOWLEDGE
a. Man
b. Society
c. Environment
natural
built
d. Man/environment
I. CONCEPTUAL BASES
ENVIRONMENTAL DESIGN
3. SKILLS
a. Analytic techniques
b. Group
c. Communication
d. Management of time and resources
II. ANALYTICAL METHODS
III. ENVIRONMENTAL DESIGN PRACTICE
IV. ADVANCED ENVIRONMENTAL DESIGN PRACTICE

Methods in developing and analyzing information about the environment with emphasis on selected computer application packages and other numerical approaches; techniques and their appropriateness for the designer. Prerequisite or corequisite, Course I.

The first session of this course covers basic statistical techniques with a brief introduction to sources of statistical data and research methodologies for generating such data. Students are evaluated by an examination and a a project. A future revision of this part of the course is contemplated.

The second session introduces students to the use of computers via a number of application packages; students are required to do one assignment applying each computer package. This part of the course had already been revised.

3. Course III: Environmental Design Practice
(96 contact hours over the second session)

Introduction to environmental design practice conducted mainly as a workshop; study of the scope and nature of environmental design problems, discussion of the kinds of intervention and practices of the various agencies engaged in control of environments; interdisciplinary projects developed around three themes: analysis, design and communications, and policy formulation; issues in environment management investigated mainly in reference to current practices in large scale planning projects. Lectures, Seminars, Projects.

This course seeks to develop skills of communication and interdisciplinary group problem-solving and design via a few introductory skill lectures and a number of short-duration projects emphasizing process and skill development. More emphasis can be placed on the application of knowledge from Course I since it is now required for first year students.

4. Course IV: Advanced Environmental Design Practice
(96 contact hours over one session)

Interdisciplinary training in environmental design practice at an advanced level, centered on case studies, information probing and analysis; culminates in a policy planning assignment and environmental design presentation on a real world problem. Prerequisite: Course III.

This course has the same objectives as Course III but approaches them via one large "real-world" problem. Student groups must begin with problem definition and carry the process all the way through to the production of a professional presentation of their solution. It is unchanged from Course F, which has generally been regarded as quite successful.

III. Conclusion

The new core curriculum was offered for the first time in 1976-77. Most students seem to have gained a working appreciation of different conceptual frameworks and their influence. This understanding was manifested in a more

holistic approach to environmental problems, particularly in the studio courses (e.g. Course III). The five faculty members lecturing on conceptual approaches, ethics, and social institutions were able to integrate the delivery of their material very effectively. Unfortunately, some of the other sections were less appropriate in emphasis or level. These problems reflected two factors: some faculty were not able to attend all the sessions, and some do not fully appreciate the need for a conceptual interdisciplinary framework. Nonetheless, the overall results were encouraging. The difficulties seem to be in implementation rather than in design.

In conclusion, the most important features of our core curriculum are the following: the discussion of different conceptual frameworks, the attempt to construct an interdisciplinary framework which encompasses ethical, political, economic, cultural and natural environmental factors; the interaction between different faculty viewpoints in one course; and the practical application of theory and skills in the studio courses. These are features which could be profitably incorporated in an environmental core curriculum at any educational level.

Appendix A : Detailed Course Outlines

UNIVERSITY OF CALGARY
FACULTY OF ENVIRONMENTAL DESIGN

CORE CURRICULUM

Course 7. (EVDS 603) — CONCEPTUAL BASES OF ENVIRONMENTAL DESIGN
(Fall and Winter Sessions)

	Lectures*
I. CONCEPTUAL APPROACHES	
A. Practical Reason	4
1. Definitions; necessary and sufficient conditions; categorization	
2. Argumentation, fallacies, validity and soundness	
3. Intuition, creativity	
4. Logical models, functions, analogies; formal logic	
B. Types of Investigation	6
1. Mathematical	
2. Systems	
3. Scientific	
a. theoretical thought and casual relations	
b. values and objectivity	
c. empirical measurement: physical, human and social	
4. Social and cultural	
5. Ethical	
C. Modes of Intervention	3
1. Design theories	
2. Planning theories	

* Each lecture is 90 minutes

II. AREAS OF KNOWLEDGE

	Lectures
A. MAN	
1. Conceptual Frameworks	2
a. man as part of the natural system - a reactive being	
b. man as intentional, normative, purposive being	
2. Humanities and Social Science Approaches to Man: man as social, psychological, economic, religious being	1
3. Biological/behavioral approach to human behavior	6
a. human development, ontogeny, population quality, stress	
b. mammalian characteristics	
c. remanent adaptations: phylogeny	
d. human diagnostic features	
B. MAN AND SOCIETY	
1. Biological/behavioral approach (examples of behavioral exploration of man applied to society and culture, chosen from the following):	2
a. resource exploitation as basis of social systems	
b. ecological theories of state formation	
c. culture and cultural change	
d. aggression and competition	
e. biological approach to ethics	
2. Ethics (action-guiding principles)	6
a. ethical dimensions of human objectives and interaction: ethical disputes, normative/descriptive distinctions	
b. ethical principles: universal objective standards, ethical relativism	

Lectures

2. (cont'd.)

c. non-ethical principles: egoism, rational self-interest, social norms

d. ethical basis of ideology

e. moral dilemmas

f. professional responsibility

g. law and morality

3. Social Institutions (political, economic, legal) 11

a. Introduction: nature of social institutions and their study, contrast with physical systems

b. basic social choices: economic and political alternatives

c. assumptions and institutions of our paradigms

i. capitalism: self-interest, private property, contract, the market system

ii. democracy: constitution, responsible and representative government, justice and equality

d. development of our present system (the liberal state)

i. economic: mercantilism, laissez-fairre, market 'failure', nationalism, the Keynesians, militarism, urbanization, mobility

ii. political: extension of the franchise, political parties, professional politicians, professional civil service, bureaucracy

e. ethical justification of state intervention (ideology)

f. implementation: law and legal techniques

g. problems of our present system:

i. influence of economic power in politics and law

ii. bureaucratic dysfunction

iii. minority rights

C. MAN AND ENVIRONMENT

1. Natural Environment (energy focus)

a. introduction to systems (covered in 'conceptual approaches')

Lectures

b. physical systems — 2

i. physical environment: hydrosphere, climate, lithosphere and definitions (power, work efficiency, subsidy)

ii. laws (thermodynamics)

iii. energy budgets, forms of energy

c. ecosystems — 3

i. ecological hierarchy: individuals, populations, ecosystems

ii. biotic communities: energy and nutrient plans, bioenergetic efficiencies

iii. dynamics: equilibrium and stability, limiting and trigger factors

2. Man and Natural Environment — 4
(man as resource consumer - Canadian focus)

a. population dynamics

b. food and agriculture

c. energy: alternative sources, costs and benefits, impact of development

3. Built Environment — 7

a. continuity and change

i. historical process

ii. scales of intervention: state, urban, housing

iii. agricultural/urban/industrial revolution

b. form and meaning in the Built Environment

i. elements of urban form

ii. architectural form and meaning

iii. housing as example

4. Society and Built Environment — 2

a. determinants of urban form

i. influence of institutions and values on urban form

ii. processes shaping urban form

iii. theories of urban form and design

Lectures

4. Society and Built Environment (cont'd)

b. community

i. definition of community

ii. physical form and social well-being

iii. social function of architecture

iv. health and pathology

v. 'non-place' urban realm

III. ENVIRONMENTAL DESIGN ISSUES 5

Application and integration of knowledge to understanding causes of current problems (e.g. population/food/energy or pollution) by a number of the course instructors

64

COURSE II. (EVDS 606) ANALYTICAL METHODS IN ENVIRONMENTAL DESIGN (Fall and Winter Sessions)

A. Research Methods (data gathering approaches) 4

1. observational

2. contact (survey, interview)

3. interactive (participation)

B. Analytical Methods 16

1. simulation

2. operations research

3. statistical: descriptive, inferential, predict

C. Computer 16

strengths, limitations in various fields of application (presently 8 computer packages in 6 areas)

36

		Contact Hours
COURSE III. (EVDS 609)	ENVIRONMENTAL DESIGN PRACTICE	
	Instructional lectures in skills	16
	Group work	50
	Presentations and problem introductions	30
		96
COURSE IV. (EVDS 701)	ADVANCED ENVIRONMENTAL DESIGN PRACTICE	
	Group work	84
	Presentations and introduction	12

A CASE FOR CONTINUING EDUCATION: ILLINOIS DEPARTMENT OF TRANSPORTATION ENVIRONMENTAL AWARENESS PROGRAM

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Springfield, Illinois

For most of man's tenure on earth he has witnessed relatively little destruction of his environment. However, in a time span of a little over two hundred years man has significantly altered the bio physical environment of the United States. Much concern has been expressed over this alteration, the increased rate at which it has taken place and the possible end effects of this process.

In response to the increasing environmental concern of Americans, Congress passed the National Environmental Policy Act (NEPA) late in the year of 1969. This act could very well be considered the single most significant piece of legislation in the decade of the 60's with regard to the livability of man's world. The natural environment is not the only aspect of the nation affected by this piece of legislation as both our economy and society in general have felt the impact of this law. For example, in the year 1973, according to a Bureau of Census report, a total of seven billion dollars was spent for environmental quality by federal, state and local governments.[1] In addition, industry and business spent 3.6 billion dollars for pollution abatement in 1975.[2]

The Illinois Department of Transportation began to feel the effects of this legislation in the early 1970's. Section 102(c) of the National Environmental Policy Act of 1969[3] requires that an environmental study, later termed an Environmental Impact Statement, would have to be written for all major projects involving the expenditure of Federal funds. The United States Department of Transportation has determined the format and content of these documents, in an attempt to conform with the intent of the law. Today the Illinois Department of Transportation has amassed considerable material to aid the content selection and drafting of these documents.

The compilation of useful data and the writing of Environmental Impact Statements is only part of the activity undertaken by the Illinois Department of Transportation in its endeavor to minimize the detrimental environmental effects of construction and maintenance. Department personnel must be made aware of the potential impact of their activity before they can direct their efforts toward mitigating

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1. Environmental Science and Technology, Vol. 10, No. 6, June 1976, p. 519.
2. Construction Digest, Vol. 49, No. 22, December 23, 1976, p. 8.
3. Public Law 91-190, 91st Congress, S. 1075, January 1, 1970.

environmental impact. Casual observation reveals a range of attitudes among Departmental employees with regard to the environment. Some are entirely without hope, some express a legitimate but optimistic concern and some are totally without regard for the future of the world.

With this idea in mind, the Illinois Department of Transportation has developed a program through the Bureau of Personnel and Business Management, the purpose of which is to inform the transportation professional of the nature of the environmental issues we face today. Basic to the program are the principles of ecology which have helped us to identify environmental problems. The efforts of several disciplines have been aimed at the analysis and resolution of these problems in the United States. Therefore, several disciplinary perspectives have been utilized in the preparation of the program.

The major purpose of this program is to get the student to recognize that there are factors in the environment which are nonquantifiable, such as beauty, happiness and open space; and that these factors should not be disregarded simply because they will not fit into any economic calculus. In the past, feasibility studies for projects have consistently omitted these factors, which is one of the reasons for the current growing environmental concern within the American citizenry. In addition, this program would investigate man's efforts to improve his environment and the consequences of his actions on the standard of living in this nation. The course would attempt to point out that the perception of environmental issues is directly affected by individual views of the world and our place in it, in relation to the rest of the world's population. Included would be a discussion of such commonly used and little understood terms as gross national product, standard of living, price and cost; and economic feasibility. Our purpose in the synthesis of this program is best summed up by Russell Train when he wrote, "Our standard of living has continued to rise at the same time that we have become increasingly less satisfied with the quality and character of our lives. We find that, as we become increasingly able to afford the 'good life', it becomes increasingly impossible to buy".[4]

The foundation for the development of this program was laid with the appointment of an environmental education coordinator followed by a statewide request for potential instructors. Volunteers for instructor training came from individuals with a broad range of educational backgrounds, including landscape architecture, biology, civil engineering, and horticulture. Following the selection of potential instructors, an instructional cadre was formed and met to establish the objectives of the Department's Environmental Education Program. These objectives were then used in determining the earliest conception of this program.

An embryonic conception of our intended program was taken to the University of Illinois where Dr. Roger K. Brown, a science educator in the College of Education, became our academic mentor. During an intensive two-week involvement on the campus of the University of Illinois, all potential instructors were exposed to: (1) extensive data on ecological principles; and (2) teaching methods. Mornings were used to teach instructional methods, while afternoons and evenings were used to introduce ecological data from a broad range of scientific disciplines. Under the direction of Dr. Brown, two aspects of our program developed simultaneously: the training of the instructional cadre and the structure and content of the course.

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4. Russell E. Train, "The Quality of Growth," Science, Vol. 184, June 7, 1974, pp. 1050-1053.

The product of this effort is an eight-day environmental awareness course titled "Ecology and Society: Implications for Public Institutions". The objectives of this course are: (1) to help the student understand the structure and function of his bio-physical environment; (2) describe and discuss global environmental problems in the context of human values and growth systems; and (3) to examine the implications of present institutional goals and behavior, including those of the Department of Transportation. These objectives are accomplished by teaching this course in four distinct modules with approximately 30 days between class meetings.

The first module in this course, titled "The Human Environment", is to acquaint the student with the idea of change, illustrating the rate, direction, and inevitability of change and comparing man-made change with natural change. The idea of ecology as a science and a point of view is presented as is a discussion of "ecologist vs. environmentalist". At the end of the day it is hoped that the student will be at ease in the classroom and that a basic foundation for future discussions will have been laid.

The second module requires three consecutive days and is titled "Environmental Dynamics". The basic objective of this module is to provide the student with a set of basic ecological principles which will aid in his understanding of the natural world as well as establish the basis for the remainder of the program. This data is built around five interacting models, each centered on what are titled the "Five Laws of Ecology". This technique was borrowed from a section of a course taught by Dr. George Kieffer at the University of Illinois in Urbana.[5] Titles for four of the five laws were taken from "The Closing Circle"[6] by Dr. Barry Commoner. The fifth law was borrowed from the writings of Dr. Garrett Hardin, at the University of California.[7]

This three day module provides the student ecological information which illustrates the flow of energy through global ecosystems, the cyclic nature of ecological systems, the interdependence of various components of global ecosystems and the inherent stability found in diverse natural ecosystems. In addition, the student is exposed to the phenomena of biosynthesis and biodegradation and the problems posed by the introduction of non-biodegradable molecules into the natural system. This phenomena is further expanded through discussion, with examples of biological magnification. This three-day class meeting is concluded with a discussion of the dilemma presented by exponential growth of human numbers. At the end of these three days the student should have a basic ecological framework within which to formulate thoughts and ideas. The student should be able to draw on this ecological framework and participate in discussions during the last half of the course. This last half is divided into two sections, each of which requires two days to complete.

The first of the two remaining sessions is titled "Managed Ecosystems". In this module the student is introduced to the idea of man managing the environment and of the success he has had in this endeavor. Data is presented to show that western man has secured a disproportionate share of the world's wealth for himself. The

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5. George H. Kieffer, "Biology 101," Stiper Publishing Company, 1973.

6. Barry Commoner, The Closing Circle, Alfred A. Knupf, New York, 1971.

7. Garrett Hardin, "Not Peace But Ecology," Diversity and Stability in Ecological Systems, Brookhaven National Laboratory, Upton, New York, 1969, p. 152.

ideas concerning human management of the environment are not new. As a result of human management, man has seemingly extricated himself from direct dependence on contemporary ecosystems for much of what appears to be crucial to his high standard of living. These ideas are discussed in some detail, then concern shifts to the illustration of man's dependency on the global environment for his existence. This idea is then validated through the use of a model titled "The Ecology of an Industrialized Ecosystem", developed by Dr. William E. Cooper of Michigan State University.[8] Next, the discussion moves to topics which include limitations posed by technology, food production, energy production, and resource availability. The idea of systems limitation is presented, emphasizing that a change in the method of thinking through problems will be necessary if any significant improvement in the global environment is to come about.

With the foregoing material to illustrate that change is necessary in a dynamic world, the discussion now comes closer to the individual student by challenging his values and discussing how ethics provide controls on his behavior. This is done by discussing the "Dominant Social Paradigm" as defined by Pirages and Ehrlich.[9] This discussion is intended to suggest to the student how his behavior and even his thought processes are formed and molded over time by his social environment. This discussion includes issues such as wilderness preservation and land conservation which combined with economic considerations challenge the student's perception of his social environment. These challenges to the student's dominant social paradigm are crucial if the student is to have an open mind for the analysis of environmental issues.

Three years of direct experience with this program have led the authors to believe that the discussion of values and ethics makes the greatest impact on the student and therefore, will, over a period of time, be the basis for change.

The last module in this course is titled "Ecological Relationships and Modeling". This module includes a rather detailed analysis of "Limits to Growth", by Meadows, et al.[10] Included in this discussion is a review of "Models of Doom"[11] which is a rebuttal to "Limits". These analyses are particularly interesting since "Limits", with its computer analysis, tends to scare and depress the student. Then, following with "Models" helps to give the student a sense of security and possibly a feeling that things really are not that bad. This discussion is then followed by an analysis of a second computer study titled "Mankind at the Turning Point",[12] which considers the criticism of "Models" and arrives at essentially the same conclusions as "Limits". Thus, the student is introduced to one of the earlier

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8. Herman E. Koening, William Cooper, and James M. Falvey, "Engineering for Ecological, Sociological and Economic Compatibility," IEEE Transaction on Systems, Man and Cylemetus, Vol. SMC-2, No. 3, July, 1972.

9. Dennis C. Pirages and Paul R. Ehrlich, Ark II, W. H. Freeman and Company, 1974.

10. Meadows, Donella H., Dennis L. Meadows, Jorgen Randers, and William W. Behrens, III, The Limits to Growth, New American Library, 1972.

11. H. S. D. Cole, Models of Doom, Universe Book, New York, 1973.

12. Mihajlo Mesarovic and Edward Pestel, Mankind at the Turning Point, E. F. Dutton and Company, Inc., 1974.

attempts at modeling global environmental problems, and is exposed to one of the many criticisms of the model. With the discussion of "Mankind" the student should be aware that there are many serious problems facing the global society of man and that concerted efforts are being made to analyze these problems. The technology and methods of analysis are not perfect, but nevertheless, are worth consideration.

Reactions to this program by Illinois Department of Transportation officials have been excellent, and, over the last three years, nearly all of the major policy making and management personnel have attended. Work is now underway to teach this course to the remainder of the decision-making professionals in the Department. Efforts are also underway to develop an annual one-day environmental seminar for graduates of this course. The reasons for this proposed one-day refresher program are twofold: first, numerous students have requested some type of on-going involvement to help keep them current on environmental issues; second, from an educational standpoint the students must be periodically exposed to current environmental issues or they will lose a substantial part of the awareness and sensitivity gained from this program.

This course was taught in 1976 at the University of Illinois and is presently listed in the Environments and People Program at Sangamon State University in Springfield, Illinois where it is a requirement of a Master's Degree Theme entitled "Creative Planning and Ecological Management". Governors State University at Park Forest South, Illinois will also list this course beginning in 1977.

Measuring the success of this program at this time is a difficult task. Test scores and other measurement devices indicate that students have retained some of the information; however, awareness which does not lead to change will be useless. Thus to obtain a valid measure of the effectiveness of a program of this type, directed at a large organization like the Illinois Department of Transportation, one will have to observe whether or not the Department conducts its business in a more ecological manner in the future. This means more than writing a better EIS, more than reducing construction-related erosion, and more than making roads attractive. It means considering the nonquantifiable amenities of open space, scenic vistas and quiet areas, considering the associated strip-growth encouraged by highway improvements, and considering people and places as being as important as growth and expansion. These ideas are best summarized in the words of Herman Daley when he wrote that environmentalists seek growth "in things that really count, rather than in things that are merely countable".[13]

13. Technology Review, Vol. 79, No. 3, January, 1977.

BELLINGHAM 2000: A MODEL FOR COMMUNITY ENVIRONMENTAL ACTION

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ABSTRACT

In September, 1974, the city of Bellingham, with the assistance of Huxley College of Environmental Studies, began a program of community involvement to provide elected and appointed decision makers with citizens' views of "desirable futures" for the city. The program lasted over two years and involved nearly 1500 citizens directly in neighborhood meetings, task forces, advisory committees, and policy teams. An additional estimated 10-15,000 people were reached through the various forms of media - newspaper, TV, and radio. The product of all this effort was a detailed report of goals, policies, and options for Bellingham in the near and not-so-near future. That report is currently being utilized by the city's planning department as a goal and policy base for the new comprehensive plan.

More importantly, a model was created for use by other communities who wish to explore their future in a creative and highly democratic manner. In August, 1976, Governor Dan Evans of Washington chose Bellingham 2000 as the top community development program in the state. He provided additional funds to Huxley College for the preparation of a "Citizens' Guide to the Future", a report which analyzes in depth the Bellingham 2000 process. It is this model of citizen involvement in the decision making process of a city that we wish to share with our fellow NAEE members.

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COMMUNITIES, CITIZENS, AND THE FUTURE

In the Summer of 1967, the American Academy of Arts and Sciences published the proceedings of a series of conferences held by a diverse group of scholars called

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* Note: Everitt and Dyckman were co-directors of Bellingham 2000, and co-authors of "A Citizens' Guide to the Future."

"The Commission on the Year 2000". The proceedings were titled Toward the Year 2000: Work in Progress. (Bell, 1968) This ponderous volume was the culmination of two years of "hard thinking" by over 40 of the nation's most distinguished scientists, philosophers, economists, and social thinkers. Though the Commission could not claim to be the first group to try to predict the future (Rand Corporation and other "forecasters" had projected future trends for years prior to 1965), it is apparent now that, in one sense, Toward the Year 2000 started a kind of revolution. This "revolution of thinking about the future" is demonstrated in many ways. One form is the proliferation of futuristic writing since 1968. The ideas, hopes and fears of the Commission were popularized in the late 60's and early 70's By Alvin Toffler's Future Shock, (Toffler, 1970), Charles Reich's The Greening of America, (Reich, 1971) Stewart Udall's 1976: An Agenda for Tomorrow, (Udall, 1968) and Robert Theobald's America II, (Theobald, 1969).

Yet in the early 70's, as with the environmental movement publicized by Earthday, everyone was talking about it (the future) but no one was doing anything about it. However, as early as 1960 a few states, regions and local communities began to take futurism or long-range planning seriously. Indeed, one urban center, Dallas, Texas, began a long-range planning program in 1966 and is acknowledged as the "pioneer" in citizen-based long-range planning. California followed suit in 1967 (California Tomorrow). By 1973, Maine, Georgia, Iowa, Hawaii, Vermont, and Connecticut had, with private or public sponsorship, produced plans, blueprints, or reports dealing with the distant year 2000.

During 1973 and 1974, the State of Washington and two of its cities began to earnestly face projections for the year 2000, and to attempt to involve its citizens in shaping the future. In 1972, the Seattle 2000 Commission was established by a resolution of the Mayor and City Council. The resolution charged the Commission with "drafting and presenting to the City Council and the Mayor goals for Seattle to achieve by the year 2000." By November, 1973, a report was ready for submission and adoption, and the final Seattle 2000 goals document was printed and distributed to the public in the early Spring of 1974.

In January, 1974, Governor Dan Evans announced the creation of the Alternatives for Washington program. In February, Evans and his office of Program Planning and Fiscal Management selected a state-wide task force of 150 citizens. Our task as stated by the Governor's letter of invitation was "to examine alternative directions for future growth and development in Washington." During a period of 12 days spread over a three-month period, the Task Force produced a set of statements about growth, development and the quality of life in Washington. These statements were then used as "data" for a series of one-day regional conferences held throughout the State. In addition, several surveys were conducted, and both radio and TV stations carried special "talk show" programs to encourage wide-spread citizen involvement in the program. By the Fall of 1973, an estimated 70,000 people had participated in one way or another. The program has experienced some difficulties during its more than two years of existence. Despite representation on the state-wide Task Force by Senators and House members from both parties, Alternatives for Washington was viewed by the Legislature as the "Governor's program." As a result, few of the recommendations produced during the program have survived legislative review. A large group of citizens began over a year ago to examine the costs and benefits of the "Alternatives", and hope to present their findings in policy form to the next session of the legislature. As a process, Alternatives for Washington is regarded as the most imaginative of any previous states' programs.

As a member of Governor Evans' State-wide Task Force, I became increasingly concerned about the future of my local area in Northern Puget Sound and, in particular, the

City of Bellingham. To me, Bellingham was a beautiful place with a lot to lose by not planning for the future. As a result of informal conversations with Dr. George Drake, a member of City Council and Associate Professor of Sociology at Western Washington State College, we explored with the city's Planning and Development Commission the possibility of a local Year 2000 program. Armed with their tentative approval, he and I submitted a proposal to the State Office of Community Development to fund a citizen-based long-range goal setting program. The result was a program that spanned over two years in time, involved over 1,100 local citizens, and produced goals and policy guidelines for both the short and long-range future of the City. The remainder of this paper is a summary of what happened during those two years, and what was produced. Those of us who professionally and/or voluntarily gave much of our lives to the program feel that the Goals for Bellingham program provided both an inventory of citizens' desires for the future, and a commentary on the worth of conducting a Year 2000 program for a mid-sized community.

This paper presents 1. a rationale for a citizen-based "Year 2000" program, 2. a description of the setting and a history of citizen involvement in the planning process of Bellingham, 3. a flow chart and narrative description of the program and 4. an epilogue which embodies the program directors' feelings and opinions about the program.

A RATIONALE FOR CITIZEN PARTICIPATION IN PLANNING FOR THE YEAR 2000

"Future shock", according to Alvin Toffler, "is a time phenomenon, a product of the greatly accelerated rate of change in society." (Toffler, 1970) It is the breaking down of cherished institutions like the family, the church, and the school. It is reflected by a society that is experiencing accelerated change, an increase in the flow and variety of information, and a growing inability on the part of humans to cope with all this change. To compound the miseries generated by these accelerated changes, we seem unable to plan for the impact of change using time-honored or traditional planning techniques. Even the most sophisticated computer is incapable of producing an accurate "model" of the future when faced with data that shifts and fluctuates with no apparent pattern. Given the increasing complexity of natural and man-made systems, and the ever-changing relationships between the two, a prediction or forecast of the future based on current trends alone may be woefully inadequate, In most cases traditional forecasting can only provide an estimate of probable futures. In order to provide society with the options necessary to cope with uncertainty, we must also plan, in some fashion, for possible, or desirable futures. Toffler argues that...

> Today as never before we need a multiplicity of visions, dreams and prophecies - images of potential tomorrows. Before we can rationally decide which alternative pathways to choose, which cultural styles to pursue, we must first ascertain which are possible. Conjecture, speculation and visionary view thus become as coldly practical a necessity as feet-on-the-floor "realism" was in an earlier time. (Toffler, 1970)

Furthermore, he states that this conjecture and speculation about the future must not be confined to those that we traditionally consider "experts."

> The time has come for a dramatic reassessment of the direction of change, a reassessment made not by the

> politicians or the sociologists or the clergy or the elitist revolutionaries, not by technicians or college presidents, but by the people themselves. We need quite literally to "go to the people" with a question that is almost never asked of them. "What kind of a world do you want ten, twenty, or thirty years from now?" (Toffler, 1970)

It was, in large part, this idea of "going to the people", or anticipatory democracy, that formed the basic rationale for Goals for Bellingham.

Robert Theobald, noted futurist, speaker and author, strongly believes in the power of citizens at the local level to affect change. However, he rejects the idea of the self-fulfilling citizen participation program that is carefully orchestrated by local government to produce the "right" results. This type of program is characterized by a dependence on existing institutions like the Chamber of Commerce, or in the creation of "blue ribbon" advisory groups whose membership is carefully selected by elected or appointed officials. He further states that programs which do not take citizen participation beyond the advisory stage are merely a perpetuation of control by elected or appointed officials over the destinies of a larger populace. Indeed, he states that "Citizen involvement based solely on the provision of opportunities to discuss issues without the creation of authority in decision-making will not fundamentally change the ways in which our society is presently structured." (Theobald, 1976) The Goals for Bellingham program, by focusing specifically on the city's new comprehensive plan, attempted to provide citizens with an element of authority in the decision making process.

On the personal level, Goals for Bellingham attempted to incorporate three important assumptions about citizen involvement in planning into its process:

Assumption 1. That the idea of anticipatory democracy ("going to the people") should be a functional part of a community's decision making process.

Assumption 2. That citizens can be vested with some degree of real authority in making political decisions, and that citizens need not be confined to advisory roles.

Assumption 3. That each citizen can attain a high level of "civic literacy", and thus be more effective in decision making as an individual and as a member of a group.

CREATING AND CARRYING OUT A YEAR 2000 PROGRAM IN A MID-SIZED COMMUNITY

Bellingham: A City At The Crossroads

For even the casual traveler, there is an obvious uniqueness about Bellingham. While its economic health depends upon a large pulp mill, food processing and packing, and retail sales, it is best known for its setting, reasonable cost of living, and proximity to recreation of all sorts. In many ways, it appears to be an ideal place to live, work, and play. Located on Northern Puget Sound, 90 miles north of Seattle, it is within two hours of three major winter sports areas, minutes away from the San Juan Islands, and less than 2 hours distance from major trailheads

leading into the North Cascades National Park and Glacier Peak Wilderness. Seventy per cent of the total land area of Bellingham's parent county - Whatcom - is publicly owned as National Forest, National Park, County Park, or National Recreation Area. With a population of less than 45,000, the city retains many small town features, and affords each citizen with a variety of recreational and cultural opportunities.

Bellingham's location and natural setting is its greatest blessing and - at the same time - represents its greatest threat. In terms of the future, Bellingham is truly at a crossroads. Presently, neither the city nor county have permanent comprehensive plans, and development continues to occur in a more or less random fashion. As parts of the city experience aging and decay, there is a rush by developers to convert vacant land into commercial or multi-family use. Recently two older neighborhoods have successfully resisted this decay and turnover with assistance from the Federal Department of Housing and Urban Development, and with effective citizen pressure to preserve low density zoning in each area. Unfortunately, many areas of Bellingham are being transformed at a rate that takes local residents by surprise, and citizen protest is frequently "too little, too late."

Citizen Participation in Bellingham

Until 1974, citizen involvement in planning in Bellingham was confined to membership on advisory boards such as the Planning Commission, to special advisory groups typified by the select Mayor's Advisory Committee, and to "reactive" bodies such as the Board of Adjustment and Board of Equalization.

In 1973, the county appointed a 50-person group to steer the progress of the new county land use ordinance. This group, called the Land Use Code Committee (LUCC) was charged with working with professional planners to create a set of land use "zones" for future development in the county. No counterpart to this LUCC was developed by the city and, except on a case-by-case basis, citizens were not routinely included in the planning process in Bellingham. There was, in fact, a growing frustration among citizens who on the one hand recognized new or rapidly growing land use, housing, and social service problems, but on the other hand were afforded little or no voice in decisions about the future.

Therefore, despite its geographic and physical uniqueness, Bellingham was, and still is to a degree, a very typical town with regard to citizen involvement in planning or decision making. Goals for Bellingham was not a full solution to Bellingham's typical disenfranchisement of citizens from the planning process. It was a beginning, and a signal to leaders that far more people were ready, able and willing to assist in speculation and participation in the city's long-range future.

A Brief Historical Outline of Goals for Bellingham

In the early Spring of 1974, Councilman George Drake and the members of the Planning and Development Commission held a number of informal discussions about citizen involvement in the planning process. Most agreed that a mechanism, or program, of citizen involvement would greatly assist the Commission in formulating goals and policies for both the short- and long-term future of Bellingham. Councilman Drake suggested that he, and other members of WWSC, seek state funding for such a program. He approached Skip Everitt, Assistant Professor at Huxley College, whom he knew to have an interest in both citizen participation and long-range planning. Together they drafted a proposal for a "Civic Partnership" program and submitted this proposal to the State Office of Community Development. This "partnership" included

the establishment of a citizen involvement program called "Goals for Bellingham." Basically, the intent of Goals for Bellingham was to provide citizens with a variety of opportunities to tell their leaders about their "desirable futures" for the City. The grant was funded under Title I of the Higher Education Act of 1964.

In the Summer of 1974, Everitt met several times with the Planning and Development Commission to plan for the organization of the program. It was decided that the first step should be the establishment of an advisory group to serve as a steering committee. After careful deliberation, the Planning and Development Commission chose ten citizens that represented a wide range of perspectives and lifestyles. Later that summer, the Advisory Group met to define its role and began assisting Everitt with program planning.

The first task for the Advisory Group was to recruit a 30-40 person Task Force to conduct a series of neighborhood workshops. From a list of over 100 names, 30 citizens agreed to serve on the Task Force. These citizens were carefully selected to represent a cross-section of the Bellingham community.

In September, 1974, Everitt selected Claire Dyckman as Associate Director for the program. Together, they conducted a 6-hour training workshop for Task Force members. Each Task Force member agreed to conduct two meetings, and a schedule was finalized by mid-October. By this time, four student interns had joined the staff. Two of these students, Larry Graser and Dave Leppansen served as staff assistants. Colleen Mosely assumed responsibility for publicity, and Gail Bingham agreed to design and conduct a comprehensive evaluation of the program. Publicity was kicked off with a mail brochure (6,000 copies) and a full-page ad in The Bellingham Herald. The program also contracted with McGraw-Hill Films to rent a series of futuristic films that were shown to the public in November.

In early October, the Mayor and City Council officially endorsed the program with a joint resolution. With this resolution and the verbal support of the Planning and Development Commission, the Task Force proceeded to the business of conducting neighborhood meetings.

During November, December and January, the Task Force held approximately 55 meetings and collected nearly 400 goals, objectives, and other statements about the future of Bellingham. Citizens were invited to neighborhood meetings by the Mayor in a letter enclosed with water bills, letters and Task Force members to their neighbors, radio and TV spots, newspaper articles and advertising, and via a telephone committee organized by Denis Newman, a citizen active in community affairs.

After the completion of the neighborhood meetings, the Task Force reconvened to sort the 400 goals into groups that would become policy teams. After discussion of the general topic areas of the Policy Teams with the Advisory Group, Planning Department, and City Council, a new publicity campaign was launched to recruit working members for these teams.

At this point (January, 1975) a public hearing was held to solicit comments about the neighborhood meetings and to ask for participation by the public in the Policy Team phase. About 100 people attended.

The Policy Teams began meeting in early February and were to formulate a preliminary document in May, 1975. During the first week of Policy Team meetings, members

of the teams were briefed by Mike Knapp, a city planner, Claire Dyckman, Ruth Weiner (Dean of Huxley College) and Jean Gallegos, on the mechanics of translating neighborhood goals into objectives and policy guidelines. Knapp also explained the fundamentals of the comprehensive plan process. During the four months of Policy Team meetings, a media presentation was shown to civic clubs, service and church groups, and educational organizations in an effort to further stimulate interest in Goals for Bellingham on the part of the community. Special emphasis was placed by the staff on involving the business-industrial community in the process, a segment of the population that was sparsely represented on the Policy Teams.

The Policy Teams completed a Preliminary Draft document for submission to the Advisory Group and Planning and Development Commission in late May, 1975. At this time reports in Education, Social Services, Pollution Control, Economic Base, Leisure Activities, Shorelines, Citizen Participation, Housing, and Transportation were submitted.

In early June, 1975, the Planning Commission and Advisory Group met and decided to withhold public dissemination of the Preliminary Draft while they conducted a thorough evaluation of the program.

Also in June, a second grant was awarded to the program to provide moneys for the production of a number of multi-media programs. These programs were designated to provide summaries of the Policy Team reports. They were distributed for viewing by community groups during the Fall and Winter of 1975 - 76.

Also in the Summer of 1975, Jean Gallegos designed a questionnaire intended to solicit public opinion about the results of the Policy Teams.

In the Spring of 1976, the results of the Policy Team meetings, and preliminary results of the city-wide survey were distributed to the Mayor, City Council and Planning Commission. In June, 1976, a group of former Policy Team members met with the staff and decided to officially conclude the Goals for Bellingham program with presentations to the Council and Planning Commission. This group further decided to reconvene as an ad-hoc citizens' group in order to analyze the possibilities for implementing many of the policy statements contained in the Policy Team document.

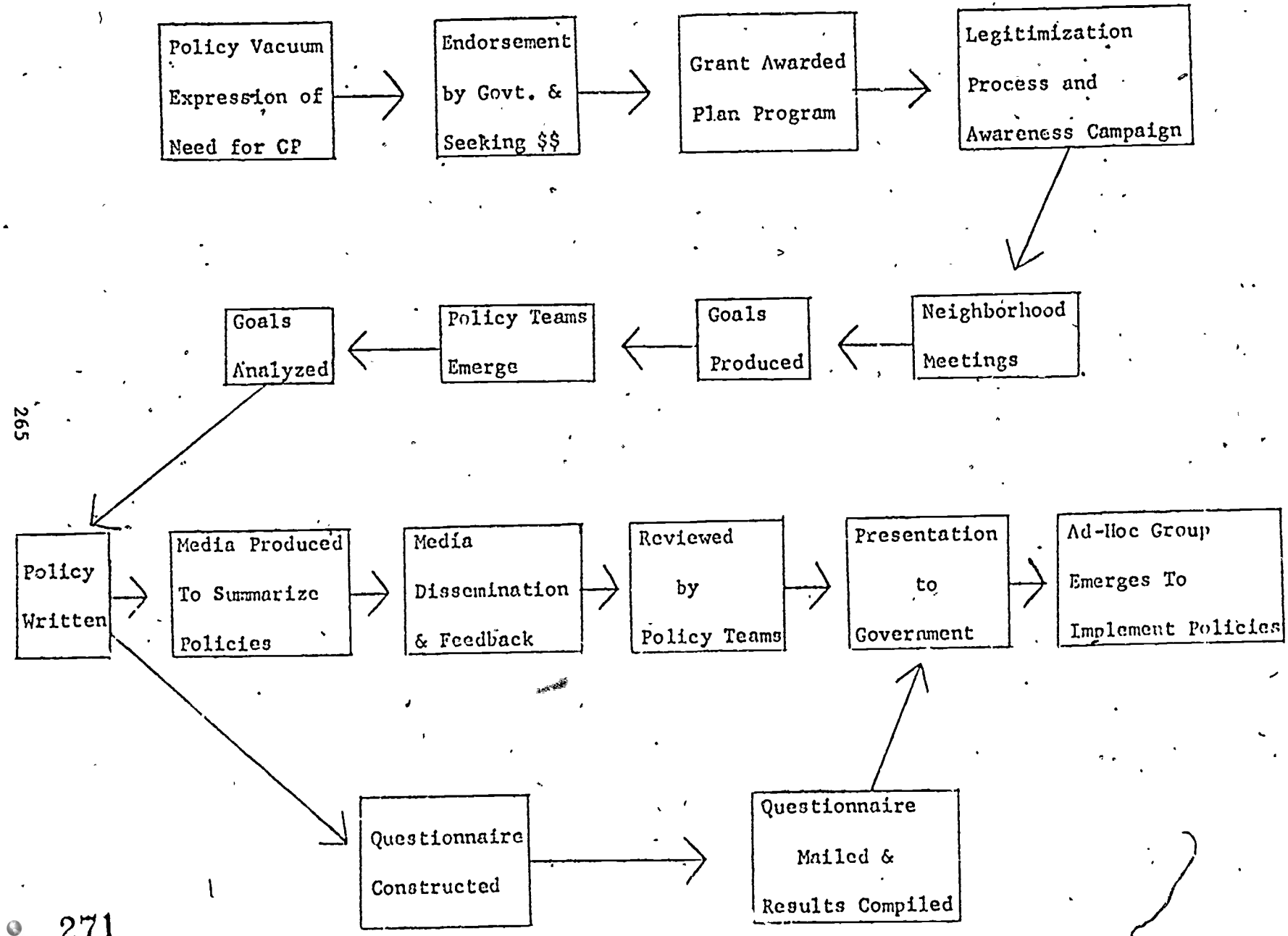
GENERAL FLOW OF GOALS FOR BELLINGHAM PROCESS

The following flow chart is a brief chronological "map" of the Goals for Bellingham process. The process, from "Policy Vacuum" to "Ad Hoc Group", covered nearly two full years.

EPILOGUE: THE FUTURE OF THE FUTURE IN BELLINGHAM

In June, 1976, the Goals for Bellingham program was officially completed. Many citizens sighed with relief as they looked forward to sailing, hiking, gardening, and "business as usual" without periodically receiving notices or calls to attend Policy Team meetings or hearings. After two years, over 1,100 fine people had written goals, served on committees, or Policy Teams, filled out surveys, viewed media presentations, or had offered advice to elected and appointed officials about Bellingham's future.

GENERAL FLOW OF GOALS FOR BELLINGHAM PROCESS



Among members of the community there are some very good and some very bad feelings about Goals for Bellingham. Generally, the government (City Council, Mayor, Planning Commission, and Planning Department) remains strongly in support of the intent of the program. On the other hand, business and industry (will) remain skeptical about Goals for Bellingham, and will probably continue to view it as a potential inhibitor to economic development.

As for those citizens who dedicated many hours to the program, a few have pledged to carry the spirit of Goals for Bellingham (on) into an action-oriented lobbying effort. In the Fall of 1976, this group of ex-Policy Team members hopes to analyze the Policy Team report from a cost-benefit perspective and to recommend programs, plans and legislation to the appropriate agencies for consideration.

While this represents an overt attempt by citizens to "finish" the process, several other results of Goals for Bellingham have surfaced since June, 1976. The Mayor has instituted a system of neighborhood organizations to advise him on future planning issues. He credits the Goals program with providing a precedent for his system and has recruited a former member of the Citizen Participation Policy Team to implement the system.

The County Parks Department has incorporated the report of the Leisure Activities Policy Team into its new long-range plan.

The Planning and Development Commission, in a letter to the Goals staff voted unanimously "to accept the Goals for Bellingham final document as input for the upcoming comprehensive plan."

Intuitively, we feel that people in Bellingham feel closer to government. Internally, the city appears to have officials who are responsive to citizen participation. Given time, both the city and county appear to have the necessary human resources needed to plan and implement a variety of desirable "alternative futures." However, it is the factor of time that leaves us far from feeling secure about the city's future. Externally, the Northern Puget Sound region is growing quite rapidly. As our future needs for food processing, energy supplies, and recreational space increase, so will the pressures increase on Whatcom County and Bellingham to provide these goods and services. Historically, we have made some tragic mistakes in similar situations, i.e., the Green River Valley near Seattle, the Coast of New Jersey and Delaware, the off-shore area of Southern California, and the back country areas of the Smokies, Sierras and Rockies. These are, for the most part, mistakes caused by no planning rather than poor planning. In these cases we have followed short-run economic "instincts" and now lament the consequences of our "progress".

Even with the marvelous human talent that resides in this mid-sized city, the task ahead will be extremely difficult and complex. There is little time to waste and a great deal to lose by "letting history take its course."

Resources

Bell, Daniel. Toward the Year 2000: Work in Progress, Houghton Mifflin, 1968.

Reich, Charles A. The Greening of America, Bantam, 1971.

Theobald, Robert. An Alternative Future for America II, Swallow, 1969.

_____. Beyond Despair, New Republic, 1976.

Toffler, Alvin. Future Shock, Random House, 1970.

Udall, Stewart L. 1976: Agenda for Tomorrow, Harcourt, Brace and World, 1968.

Ziegler, Warren. "On Civic Literacy", EPRC Syracuse University Research Corporation, 1974

CLASSROOMS AND COMMUNITY: A MODEL FOR INSERVICE TRAINING OF URBAN TEACHERS IN ENVIRONMENTAL EDUCATION

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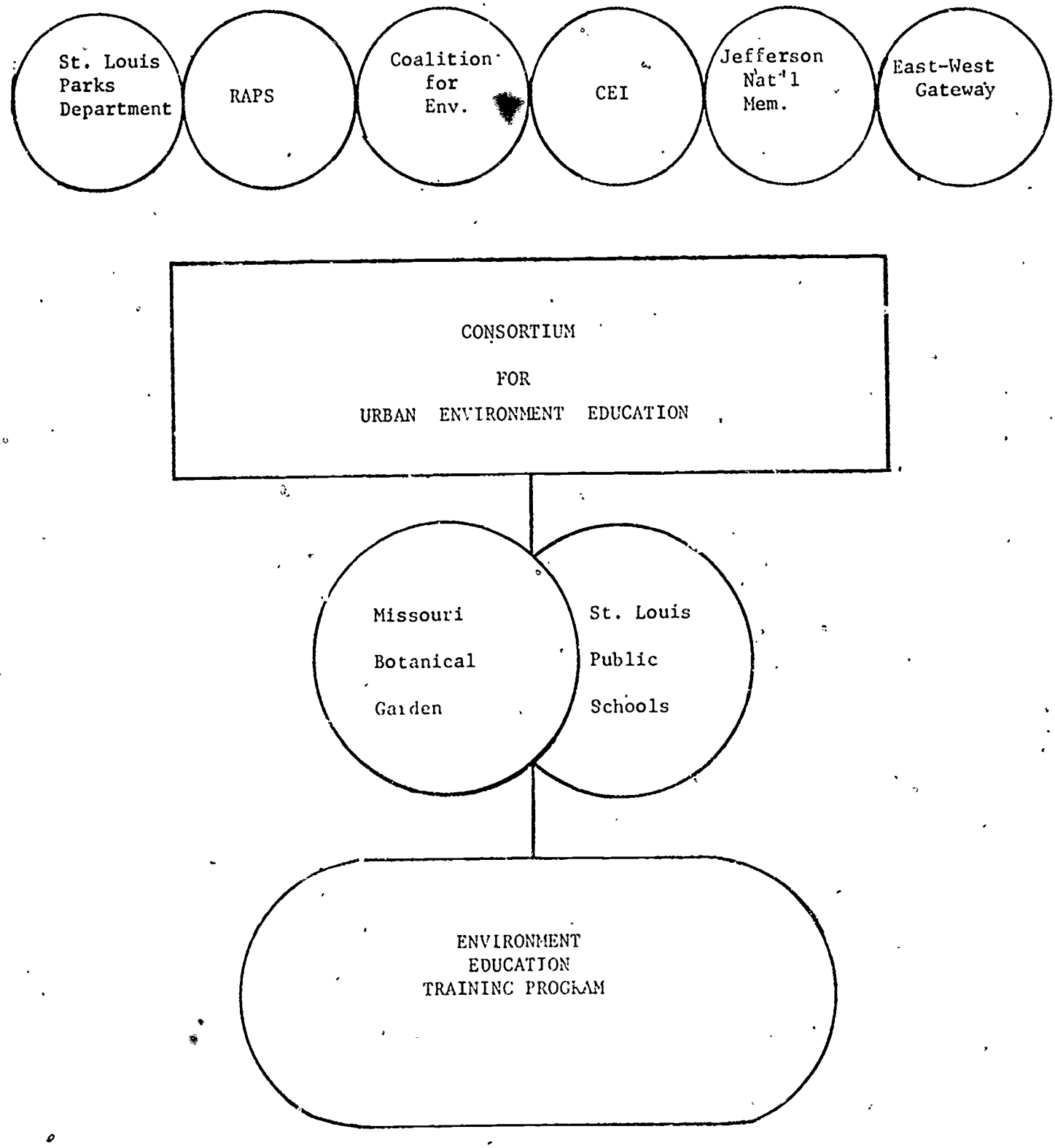
The U. S. Office of Environmental Education has awarded a grant to the St. Louis Public Schools and the Missouri Botanical Garden to develop a model for training teachers of Grades 4, 5, and 6 in a multi-disciplinary, multi-process approach to environmental education for urban areas. The project is designed to respond to concerns of local and national educators that environmental education programs today present a fragmented approach toward such issues as air and water pollution, urban land use, energy, and wildland conservation. Problems are examined and solutions proposed by specialists in a multitude of agencies representing the gamut of scientific, social, and aesthetic disciplines. Often these specialists work in isolation from one another with little coordination or concentration of effort toward a problem. Unfortunately, environmental education frequently mirrors this view of the environment as a patchwork of unrelated problems and solutions.

The position of the Environmental Education Training Project is that the environment must be perceived in a much broader view--one that stresses the interrelationships among all parts of the environment. It is within this framework of understanding that people must make decisions about the allocation of the earth's resources and the quality of life that they are willing to accept.

Environmental education, to be successful and useful for today's children, must present this more comprehensive and unified picture. Central to the implementation of this objective are new concepts and schemes for institutional cooperation and involvement in school programs. It is important, therefore, that teachers be trained in the multi-disciplinary and multi-process requisites of environmental education and that available community resources be used effectively and creatively in providing meaningful experiences for children.

The goal of the Environmental Education Training Project is to develop a teacher training model that will take an important step in meeting these objectives. The project involves the participation of twenty teachers in urban schools who have received summer workshop training in environmental education concepts and curriculum development. During the 1976-77 school year, project teachers have created mini-units in environmental education, and next year they will provide workshops and other training assistance for teachers throughout the city system.

An important feature of the training program is the organization of an ad hoc consortium, a diverse array of institutions in the St. Louis area which have resources to offer educators in environmental education. The consortium includes over twenty-five cultural, civic, educational, and environmental institutions and organizations. The purpose of the consortium is to develop the portion of the training model that relates to the utilization of community resources. Specifically, consortium members have assisted project staff in developing a process for classroom teachers to better utilize community resources in providing experiences for children which will build their understanding of the environment and formulate solutions to urban environmental problems. Figure describes the consortium's



CONSORTIUM FOR URBAN ENVIRONMENT EDUCATION

ADVISORY CAPACITY: Planning
Conceptualization
Evaluation

TRAINING CAPACITY: Content
Process

FIGURE 1

organizational relationships; Figure 2 describes the task and process interrelationships among the consortium, the St. Louis Public Schools, and the Missouri Botanical Garden.

In developing a model or process for the utilization of community resources, the project staff focused on four areas: (1) organizing community institutions and agencies to provide leadership and support in curriculum development and teacher training; (2) exploring and developing mechanisms for utilizing community resources to provide alternative learning environments for children; (3) exploring and developing mechanisms for utilizing community resources to provide teacher training and curriculum development experiences for teachers; and (4) building and expanding avenues of communication between classrooms and community.

This paper sets out a brief discussion of each of these areas; a more detailed presentation may be found in the project's final report.

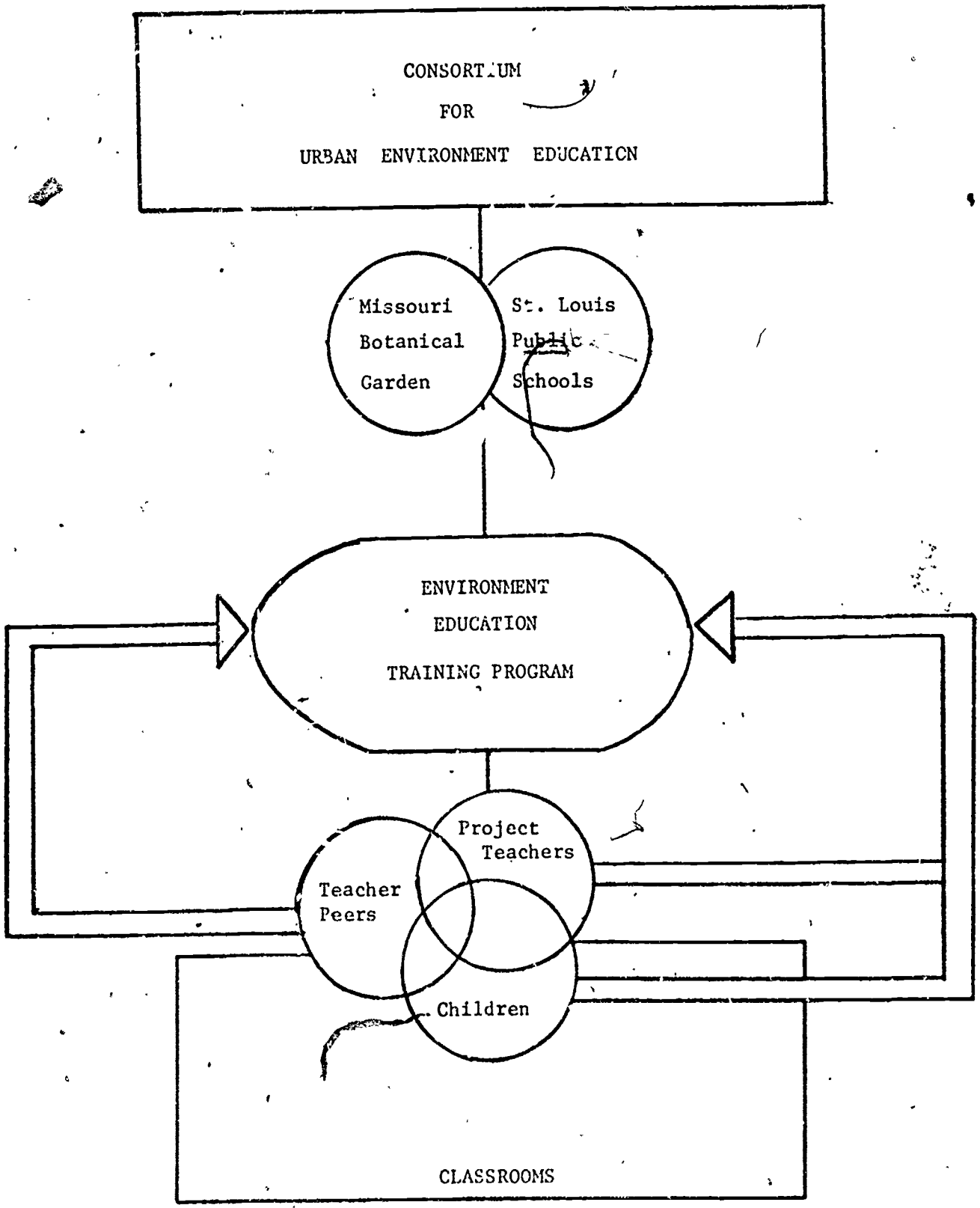
1. Organizing community institutions and agencies: It is essential, we believe, that a community institution or agency be willing to assume responsibility for organizing a consortium of groups in the community which have resources to offer in environmental education. It is equally essential that this work be done in cooperation and in conjunction with the school system to be served. Community resources, if they are to be useful to teachers and administrators, must be organized in such a way that they fit in with the needs of the district and the needs of teachers. We have found that cooperative organization helps to avoid the development of situations where outside groups begin to take it upon themselves to determine what should be taught in schools. This attitude, if it is held by people in a community agency, can drastically reduce the agency's effectiveness.

   A cooperative organizational mode can assist a school system and the teachers within it to structure a curriculum that goes beyond the resources available within the system. Such an organizational mode can benefit community agencies, too, for this kind of organization gives them a legitimate mechanism for making input into the school curriculum. Thus, their contribution is enhanced.

   In the St. Louis project, we were impressed with the diversity of groups which wanted to contribute to the schools' environmental education curriculum. If utilization of the consortium is to be successful, it is of the utmost importance that the integrity of each participating institution be respected. It is not the function of the organizing group to pass judgment on the merits of the groups' contributions or the "soundness" of their differing institutional goals and philosophies.

2. Utilizing community resources to provide alternative learning environments: Community resources can be utilized in this area in two major ways: (1) they can give assistance to school people in site development, and (2) they can develop programs to be presented at their own sites. Site development assistance is usually given in conjunction with planning new curriculum; therefore, this activity is subsumed under the following category.

   Programs and presentations conducted at the agency's own site are usually associated with museums, parks, botanical gardens, historic houses and farms. In the St. Louis project we have identified a number of mechanisms to assist these groups in providing alternative learning environments. It is important that the institution be cognizant of some of the constraints under which the urban teacher must operate. Setting up an appointment to visit the site must be a relatively easy procedure. Teachers have access to telephones only



TRAINING PROGRAM EVALUATION/REVISION FEEDBACK FLOW

FIGURE 2

briefly during the school day. An institution which wants maximum utilization of its site must have a workable appointment procedure. Equally important is the recognition that teachers do not control bus schedules. The institution's program must be flexible enough to fit in with transportation constraints. Thirdly, the institution must really want groups of children to come. This means having a place where students can eat sack lunches, wait for their bus, and store their coats and purchases. Also, it means designing a program geared to the interest level of children and one which permits tactile interaction. This does not mean that children should be allowed to touch everything in a museum or pull up plants in a garden, but we are suggesting that there be some provision for children to touch and feel, and interact with the learning environment.

Most importantly, is the attitude of staff persons who will be in contact with the children. These people must be genuinely interested relating to their visitors and should possess a high level of sensitivity to their needs.

3. Utilizing community resources to provide teacher training and curriculum development: In the St. Louis project, we found that community resources were most effective in this area when the involvement came about through self-selection. It is important that the organizers take great care in identifying the target group to be served, the specific needs of the target group, and the specific kinds of input desired from consortium members.

Once a group has identified itself as wanting to participate in specific teacher training and/or curriculum development activities, it is important that the organizers provide a framework for the group's involvement. Participants should share a common understanding of the overall goals of the activity and the context in which the immediate task fits. In addition, they should be aware of the organizer's expectations in terms of process and product and a schedule for accomplishing the work should be explicit. Once these conditions have been set out, we found it useful to identify a leader from within the participating group to serve as a facilitator and reporter.

4. Building and expanding avenues of communication: Key factors in this area are that information for teachers must be accessible, accurate, up-to-date, and complete. Teachers require a lot of advance notice if they are to be able to take advantage of the resources available in the community. Also, if they are to weave community resources into the school curriculum, they need to know in specific terms the kinds of programs, materials, and consulting help that are available.

Perhaps most crucial to building and expanding avenues of communication is a commitment on the part of people in community agencies and a commitment on the part of teachers. Each group must perceive the other as allies in the education of children, each with different kinds of responsibilities to the education process, each with different kinds of skills and expertise, and each willing to share in an atmosphere of cooperation and professional respect. If these factors are present, teachers will begin to assemble their own consortium of community agencies and the agencies, in turn, will expand their constituencies and their effectiveness.